MODERN PLASTICS

JULY 1945

DUREZ AND DIAMOND DUST

The importance of diamond dust abrasive wheels to the war effort cannot be overstated. For cutting such items as tungsten carbide or synthetic sapphires required in the vital production of precision bearings, they have no equal. Among the leaders in this highly specialized field is the George A. Greenlee Company, producers of the efficient grinding wheels illustrated above. These wheels are molded from a Durez phenolic compound, a Durez bonding resin and diamond dust.

Until recently, it was common practice in the manufacturing of grinding wheels to use a steel body or hub around which was formed the grinding rim. Because this rim contained costly diamond dust, this method of manufacture seemed essential in order to hold to a minimum specific dimension.

Plastic Hub

When some manufacturers attempted to change over to a compression-molded plastic hub, the problem of maintaining this specific thickness dimension of the rim proved to be the greatest obstacle. However, the success with which the George A. Greenlee Company engineers overcame this stumbling block is evident in the above-illustrated diamond dust wheels now being produced by them.

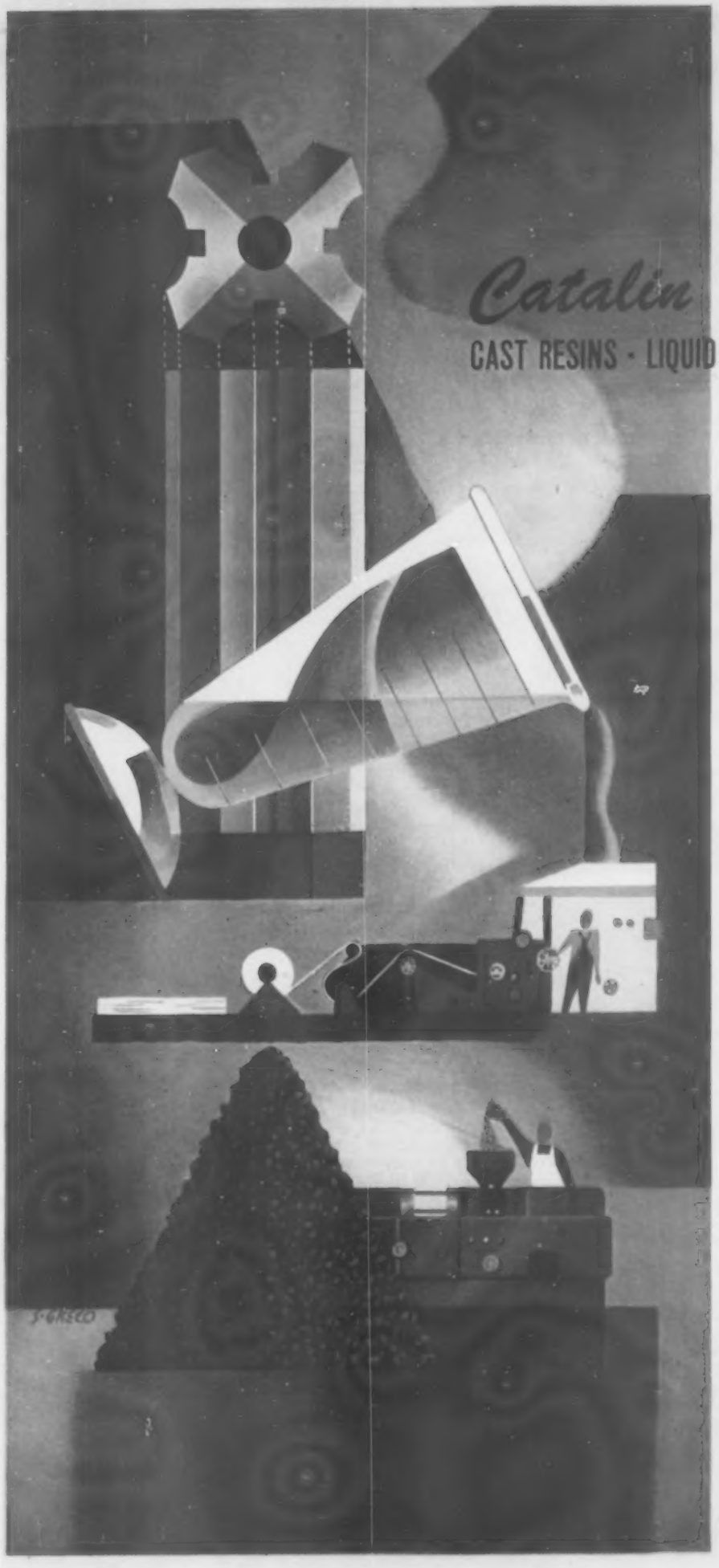
The hub is first preformed of a high-impact Durez molding compound. In conjuction with this, the grinding rim of diamond dust, filler, and a Durez phenolic resin bonding agent is also preformed. Then the two preforms are molded under heat and pressure until they become a homogeneous unit. The problem of holding the rim to the desired thickness was solved by an ingenious molding method developed by Greenlee engineers.

Unusual Versatility

The unusual versatility of Durez phenolic plastics and resins has resulted in their ever increasing use throughout practically all fields of industry. Such properties as impact strength, dielectric strength, and heat, moisture, and chemical resistance, render them invaluable to the design engineer.

Perhaps you have a plastic material problem. If so, we suggest that you take advantage of the quarter century's experience which makes up the background of Durez technicians. The benefits which this experience and a tremendous accumulation of proved data can provide are available at all times towards helping you find the plastic that fits your job. Durez Plastics & Chemicals, Inc., 267 Walck Rd., N. Tonawanda, N.Y.

PLASTICS THAT FIT THE JOB



PUBLIC LIBRARY
JUL 5 1945
DETROIT

CAST RESINS · LIQUID RESINS · MOLDING COMPOUNDS

. . . Each type is sub-divided and classified into many formulations. All were developed to meet specific functional or decorative requirements.

CAST RESINS . . . "Catalin" and "Prystal" cast phenolics in sheets, rods, tubes, shapes, are available in a limitless range of gem-like colors, These plastics fabricate as easily as brass or hardwood. Tools for special designs can be quickly and inexpensively produced.

LIQUID RESINS . . . "Catabond", "Catavar" and "Loabond" are employed in coating, laminating, glueing, bonding and impregnating various materials such as wood, plywood, abrasives, leather, paper, etc.

"Catalin Casting Resins" are used in producing low-cost tools for the fabrication of aluminum sheets. They also excel as drill and saw jigs, router, shaper and hydroform blocks, checking fixtures, stretch press molds and dies—particularly those involving contours.

MOLDING COMPOUNDS

Thermoplastic . . . "Loalin" polystyrenes possess outstanding electrical, chemical, thermal and mechanical properties; are dimensionally stable, light in weight and low in cost. Available in a broad range of colors.

Thermosetting . . . "Catapak"—for compression molding. Meets low-cost, high-impact strength requirements.

Upon request, the members of Catalin's technical staff will be very glad to direct their plastics know-how to your problems or plans.

CATALIN CORPORATION
ONE PARK AVE., NEW YORK 16, N. Y.

Catalin

MODERN PLASTICS

AND PLASTICS

CHARLES A. BRESKIN, *Editor and Publisher*
HARRIET B. JOSEPHS, *Assistant Publisher*
LAURA E. MORRISON, *Managing Editor*
DR. GORDON M. KLINE, *Technical Editor*
FRED B. STANLEY, *Engineering Editor*
ELLEN M. LYNN, *Associate Editor*
SHIRLEY SMARR, *Assistant Editor*
R. L. VAN BOSKIRK, *Washington Editor*
PAUL D. AIRD, *Contributing Editor*
KATHLEEN SKELTON, *Contributing Editor*
DONALD R. RUTHER, *Art Director*
F. M. TANENHAUS, *Readers' Service*

BUSINESS STAFF

ALAN S. COLE, *General Manager*
P. H. BACKSTROM M. A. OLSEN
DANIEL M. BROADS, *Director of Purchasing*
F. R. HARRIS, *Production*
WALTER S. ROSS, *Circulation Director*
J. M. CONNORS
221 N. La Salle St., Chicago 1, Ill.
R. C. BEGGS
815 Superior Ave., Cleveland 14, Ohio
L. B. CHAPPELL
427 West 5th St., Los Angeles 13, Calif.

All editorial contents bearing on military subjects have been released for publication by the Armed Services.

MODERN PLASTICS is regularly indexed in the Industrial Arts Index.

Member Audit Bureau of Circulations

EXECUTIVE and EDITORIAL OFFICES: 122 E. 42nd St., New York 17, N. Y. WASHINGTON 6, D. C., OFFICE: 625 Colorado Bldg., 14th & G Sts. Published the 20th of the preceding month by Modern Plastics, Incorporated. Publication Office, Twentieth and Northampton Sts., Easton Pa., Subscription price $5.00 per year, $8.00 for 2 years in U. S., its possessions and South America. Canadian subscriptions $5.50 per year, $9.00 for 2 years, all other countries $6.00 per year, $10.00 for 2 years, payable in American money or its equivalent. Price 50¢ per copy. Copyright 1945 by Modern Plastics, Inc. All rights reserved. Printed in U. S. A. Entered as second class matter, May 28, 1940, at the Post Office at Easton, Pa., under the act of March 3, 1879. Member of the Audit Bureau of Circulations. Back numbers 3 months or more preceding current issues, when available, $1.00 each. Modern Plastics is fully protected by copyright and nothing that appears in it may be reprinted, wholly or in part, without special permission.

VOLUME 22 JULY, 1945 NUMBER 11

General Section

Shoes—today and tomorrow 93
Properties of vinyl shoe sole materials . . . 100
Dip coating with gel lacquers 102
Proposed designs for wire recorders 103
New president of S. P. I. 106
A report from the Pacific 107
Mapping the eye on acetate sheets 110
Moldings for induction heating unit 112
Plastics in review 114
Occupational therapy 116
Sailboats with molded hulls 119
Forming transparent enclosures 122
Plastics products 124
Fifteen seconds to jump 126
Allocation of machinery 178
Molded casket hardware 182

Plastics—Engineering Section

Core materials for sandwich structures . . . 127
Sandwich structures with foamed core . . . 132
Honeycomb core in sandwich structures . . . 136
Melamine solves pumping problem 140

Technical Section

Impact strength of plastic materials at various temperatures 145
Technical briefs 155
Plastics digest 158
U. S. plastics patents 159

News and Features

Books and booklets 161
New machinery and equipment 174
Washington round-up 176
News of the industry 180

This is GEON 101, a very fine powderlike material. To insure uniform particle size, all must pass through 42 mesh screen.

An important advantage offered by GEON *polyvinyl resins*

NEW users of GEON polyvinyl materials are invariably delighted to discover that these resins provide definite processing advantages resulting directly from the *uniformity* of the raw material.

For example, with GEON resins it isn't necessary to mix several batches together in an effort to get uniformity in the base material. Nor is there any need to adjust processing machinery frequently to compensate for batch-to-batch variations of the plasticized product. The formula used yesterday with one batch of GEON can be used today and tomorrow with new batches. And the finished product will be uniform—and that means satisfied customers, fewer rejects, better profit.

All this is true because manufacturing methods for GEON result in a material that is *uniform*—batch after batch after batch are all alike within close tolerances controlled by rigid specifications. For example, specific viscosity limits for GEON 101 are .52—.57. To control particle size, 100% must pass through 42 mesh screen.

Another important advantage of GEON is that the right *combination* of properties for your product can be selected to meet the specific conditions of end use. These properties include resistance to water, heat, cold, aging, wear, abrasion, sunlight, chemicals, and many other normally destructive factors. For more information write Department II-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

Geon
Polyvinyl Materials

B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY

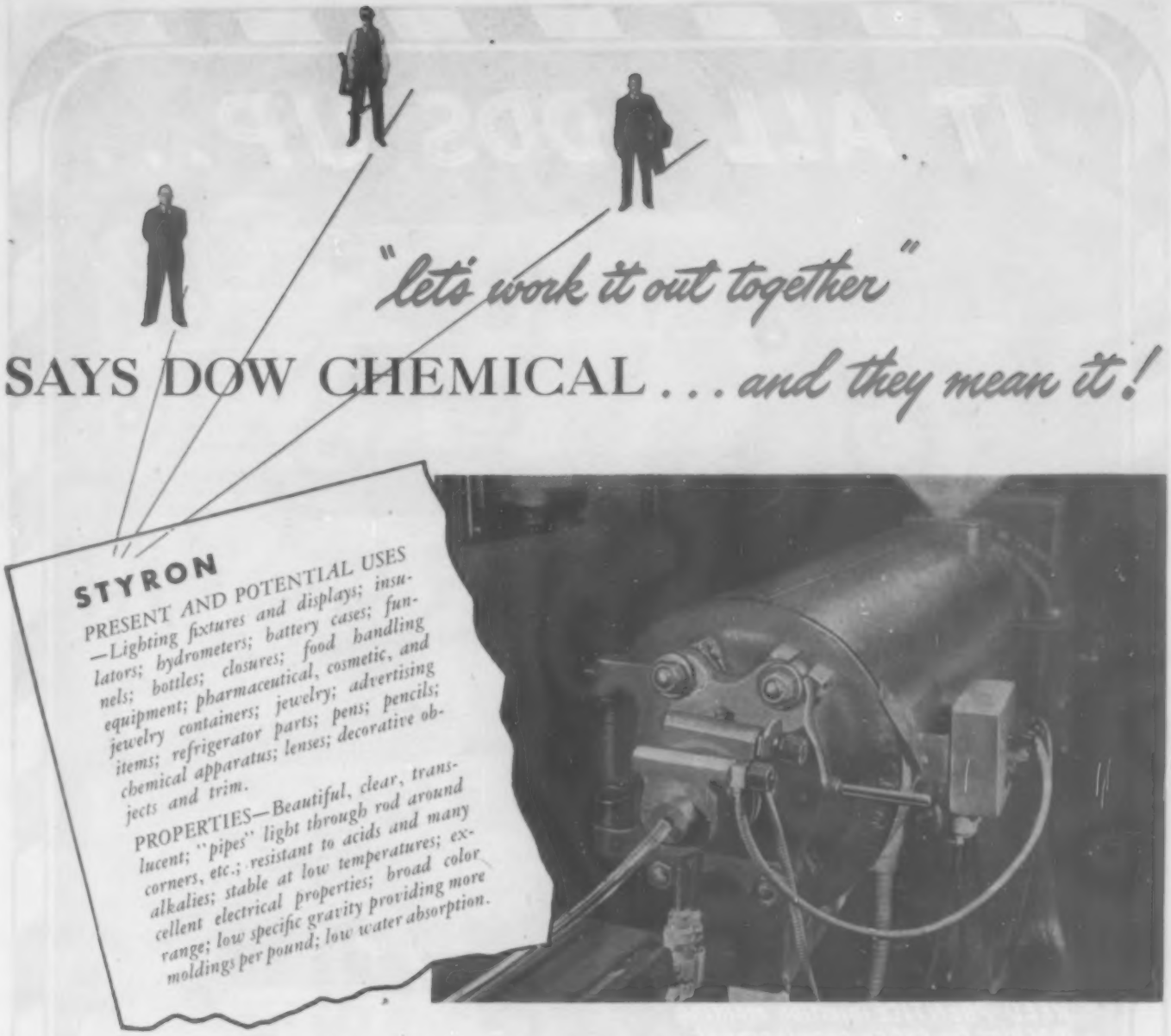
• This isn't an unusual statement at all—not when you're talking about punched parts made of Laminated INSUROK! For in the electrical insulation field Richardson *precision* plastics have long been favorite materials . . . used by the millions in all shapes, sizes and thicknesses.

This outstanding preference is easy to understand, for Laminated INSUROK is an easy-to-handle product whose physical characteristics remain commercially uniform. It can be drilled, punched, sawed, turned, planed or milled in your own shop — without special tools — or Richardson Plasticians will do it for you. Write today for the full story about INSUROK . . . laminated and molded.

INSUROK *Precision Plastics*

The RICHARDSON COMPANY

MELROSE PARK, ILL. NEW BRUNSWICK, N. J. FOUNDED 1858 INDIANAPOLIS 1, IND. LOCKLAND, CINCINNATI 15, OHIO
DETROIT OFFICE 6-252 G. M. BUILDING, DETROIT 2, MICHIGAN NEW YORK OFFICE 75 WEST STREET, NEW YORK 6, N. Y.
CLEVELAND OFFICE 326-7 PLYMOUTH BLDG., CLEVELAND 15, OHIO


"let's work it out together"
SAYS DOW CHEMICAL . . . and they mean it!
STYRON
PRESENT AND POTENTIAL USES—Lighting fixtures and displays; insulators; hydrometers; battery cases; funnels; bottles; closures; food handling equipment; pharmaceutical, cosmetic, and jewelry containers; jewelry; advertising items; refrigerator parts; pens; pencils; chemical apparatus; lenses; decorative objects and trim.
PROPERTIES—Beautiful, clear, translucent; "pipes" light through rod around corners, etc.; resistant to acids and many alkalies; stable at low temperatures; excellent electrical properties; broad color range; low specific gravity providing more moldings per pound; low water absorption.

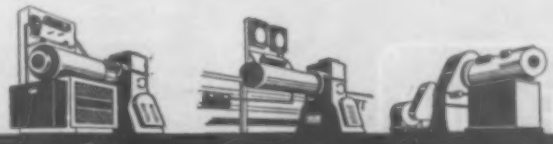
WHEN The Dow Chemical Company develops new plastics and improved formulations, they believe in "working it out together" with the people who are *using* and *fabricating* those plastics. That's why they consider it so important to use in their development laboratories, equipment which they know is the most advanced in design and operation, and as nearly as possible the "standard of the industry".

For instance, as part of their research on Styron, skilled Dow technicians use National extruders to check current production of materials and to develop *new* polystyrene compounds with excellent clarity, dimensional stability, and improved extrusion characteristics that can be produced at a fast rate commercially.

In selecting National Plastics extruders for their research laboratories, Dow is using the same type of units that *most leading fabricators* rely upon for the dependable, low-cost extrusion of all kinds of plastic and synthetic compounds.

Whether in the laboratory or in mass production . . . for *flexibility* and *precision control* . . . there's a type and model of National extruder that will ideally meet *your* requirements.

For descriptive data on National plastics extruding equipment, refer to your 1945 Plastics Catalog. Or, write National Rubber Machinery Company, Akron 11, Ohio.



NATIONAL RUBBER MACHINERY CO.
General Offices: Akron 11, O.

Plastics
MACHINERY DIVISION

IT ALL ADDS UP...

10H—22 oz. Injection Molding Machine

IT ALL ADDS UP—to the most complete and largest selling line of plastic injection molding machines in America, built by REED-PRENTICE.

MODERN DESIGN—construction enables machine to operate at rapid mass-production speeds.

+DEPENDABLE OPERATION engineered and built to run on 24 hour schedule.

+AUTOMATIC CONTROL—central operating panel within easy reach—the operator is safeguarded by many automatic features.

+PRECISION PERFORMANCE—plastic injection molding of intricate parts to exact specifications.

+COMPLETE MACHINE RANGE—a REED-PRENTICE injection molding machine for every requirement. Available in 22, 16, 12, 8 and 6 oz. sizes

TRIED AND PROVEN since 1936—REED-PRENTICE injection molding machines will mold peace-time plastic products cheaper, better and faster—it all adds up to SATISFACTION.

MODEL 10F—16 oz.

MODEL 10E—12 oz.

MODEL 10D—8 and 6 oz.

to SATISFACTION!

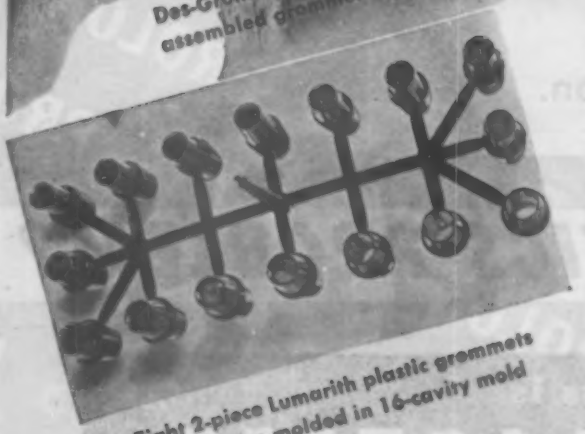
REPRESENTATIVES IN
Chicago - Milwaukee - Detroit - Syracuse
Grand Rapids - Minneapolis - Houston
Los Angeles - San Francisco
IN CANADA - Toronto - Montreal and Walkerville

INJECTION
REED-PRENTICE CORP.
WORCESTER MACHINES MASS., U.S.A.

NEW YORK OFFICE: 75 West St., New York 6, N. Y.
CLEVELAND OFFICE: 1213 W. 3rd St., Cleveland 13, Ohio

PERHAPS YOU WOULDN'T THINK OF USING *Plastics* HERE

Dee-Grommet components and assembled grommet



Eight 2-piece Lumarith plastic grommets are injection molded in 16-cavity mold

A product designer did . . . producing a new and improved grommet design using a special flame resistant Lumarith* CA formulation.

THERE ARE sound reasons why Jan De Swart of Victory Manufacturing Company turned to Lumarith plastics when he developed the "Dee-Grommet" for use on U. S. naval vessels. In abrasion tests using braided metal cable the Lumarith grommet showed less deterioration than did grommets made of lead, and caused far less wear to the braided cable than steel grommets did.

By taking full advantages of the physical characteristics of Lumarith, the Dee-Grommet is designed to be self-locking, capable of blind installation (from one side of partition), and adjustable to as many as five different wall thicknesses. A special *non-burning* formulation of Lumarith CA (cellulose acetate) was used to meet Maritime Commission requirements for fireproof material.

The use of Lumarith in place of metal reduces production time and manufacturing costs. Grommets are injection molded in a matter of seconds—using multiple cavity molds. Finishing and polishing operations are reduced to a minimum. No machining, plating or enamelling is required.

The development of the Dee-Grommet is a good example of the right approach to plastics. It is the type of project that the technical staff of Celanese is prepared to help you accomplish with your product. Your inquiries are invited. Celanese Plastics Corporation, *a division of Celanese Corporation of America*, 180 Madison Avenue, New York 16, New York.

LUMARITH*

A Celanese Plastic*

*Reg. U. S. Pat. Off.

MEET MR. ANT'NY

Big businessmen,
little businessmen,
pour out their hearts
to our Mr. Ant'ny
about
plastics.
Backed by our experience
as world's largest producer
of injection-molded
heavy section pieces,
he helps separate
the futile dreams
from the sound plans,
the profitable facts
from the costly fiction.

HAVE YOU A PLASTICS PROBLEM?

Our Address is

PROLON PLASTICS

A Division of

PLASTIN*

VINYL-ALUMINUM MOISTURE-VAPOR BARRIER

PRODUCTION OF PLASTIN **is currently devoted to filling the unprecedented military demands for this unprecedented moisture-vapor barrier, which surpasses all Type I barrier requirements for maximum load limits under Method II packaging.**

The time will come—perhaps very soon—when Plastin can fill *your* needs for positive protection against corrosion. Samples adequate for introductory and testing purposes are now available. Learn why Plastin is preferred to any other moisture-vapor barrier heretofore known. Send for folder containing description and small samples of Plastin.

PLASTIC FILM CORPORATION

PHONE: LEXINGTON 2-5450 • 475 FIFTH AVE., NEW YORK 17, N.Y.

*Patents Pending
Trade Mark Reg. U.S. Pat. Off.

FILL OUT AND MAIL TODAY!

PLASTIC FILM CORPORATION
475 Fifth Avenue
New York 17, New York

Gentlemen:

Please send a free copy of "An Introduction to Plastin" to:

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

In Gem Cutting the most precious stones are entrusted only to craftsmen of long proven, trustworthy skill.

IN ADHESIVES the formulation and application of synthetic resins to today's bonding problems is best entrusted to technicians of long practiced, specialized skill. National . . . a specialist for half a century in all types of industrial adhesives and a pioneer in the development of synthetic resin adhesives . . . offers you the advantages of an experience that goes far beyond the formulation of a single type or limited group of resins. All types, both singly and in blends of high complexity are employed for packaging, converting, assembling. And each recommendation . . . on the basis of performance . . . can fully justify itself economically. Inquiries are invited — NOW!

• *Offices:* 270 Madison Avenue, New York 16; 3641 So. Washtenaw Avenue, Chicago 32; 735 Battery Street, San Francisco 11, and other principal cities. In Canada: Meredith, Simmons & Co., Ltd., Toronto and Montreal. In England: National Adhesives Ltd., Slough, Bucks.

National ADHESIVES

EVERY TYPE OF ADHESIVE FOR EVERY TYPE OF ADHESION

PLASTIC FUNCTIONAL MEMBERS

TINY BUT

MIGHTY

LOWER COST

COMPACT SIZE

LIGHTER WEIGHT

EASIER ASSEMBLY

BETTER PERFORMANCE

SIMPLIFIED FINISHING

One or several plastic components, weighing the merest fraction of an ounce, costing a small fraction of a cent, can have far-reaching effects on the over-all performance of your product. The remarkable properties of plastics can be employed to obtain a combination of structural strength together with electrical insulation, heat insulation, resistance to abrasion and other desirable characteristics.

The success with which plastics can be adapted to your needs depends largely on the skill of the molder . . . his ability to hold close dimensional tolerances, to insure homogeneous grain structure, to produce in quantity at economical cost . . . and to deliver on schedule. During the war years MOLDED PRODUCTS has amply demonstrated these abilities. Ask one of our engineers to assist you in planning for the competitive postwar period. MOLDED PRODUCTS CORPORATION, 4533 W. Harrison St., Chicago 24, Illinois.

PLASTICS DIVISION

MOLDED MPC PRODUCTS

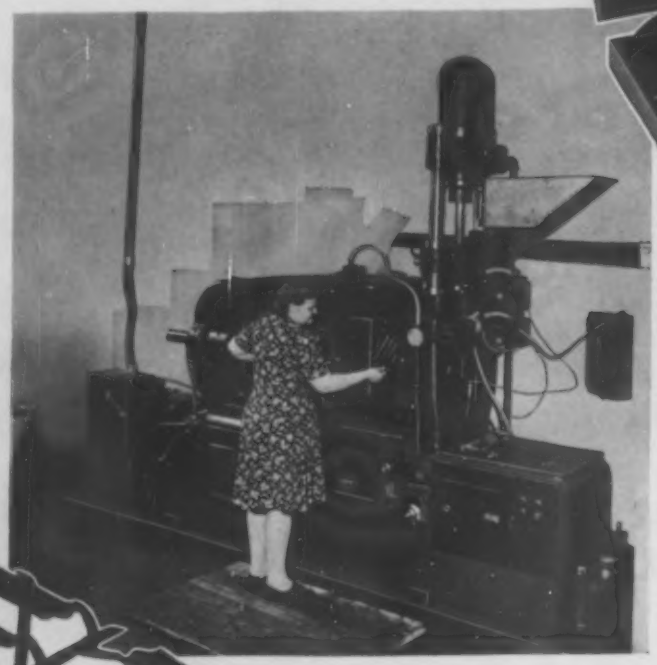
CORPORATION

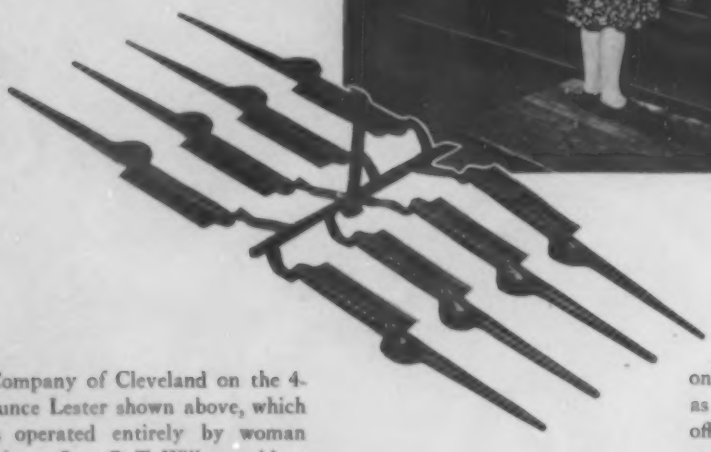
Injection MOLDING

NUMBER SEVEN OF A SERIES

With the capacity of injection molding machines increasing by leaps and bounds to meet the demands of present-day industry, many machinery builders (including Lester) are inclined to place most advertising emphasis on their latest and largest models. We should not forget, however, that most injection moldings are still under a pound in weight, and that many molders need small, fast, easily operated machines.

The 4-ounce Lester, for instance, has adequate capacity for a multitude of small, light-weight parts such as the G.I. safety razor box and Wac combs shown on this page. The former, weighing approximately 1½ ounces per unit, is molded of cellulose acetate in a 4-cavity mold, producing 2 complete boxes per shot, and a total of 4800 boxes per 16-hour day. The comb molding is made of the same material and is produced at the rate of 120 shots, or 960 combs, per hour.





These products are made by the Wills Plastic and Engineering Company of Cleveland on the 4-ounce Lester shown above, which is operated entirely by woman labor. Says O. T. Wills, president of the company: "Girls who never saw a plastic molding machine before can operate this Lester expertly in a week. Rejection rates run considerably less than 1 percent of total production, and down time of the machine is negligible." Thus Lester automatic operation and simplicity of design help to maintain high production schedules and high operating efficiency in the face of the wartime manpower shortage.

To quote Mr. Wills further: "In my opinion, the Lester is the best comb machine manufactured; we have no trouble filling out the teeth in an 8-cavity mold, though this is ordinarily one of the difficult jobs of injection molding." This illustrates the value of the patented Lester injection system, which plasticizes the material perfectly and applies maximum pressure to it *in the mold cavity*, driving it easily to the extremities thereof.

But no single feature of Lester machines is responsible for their superior performance. The solid steel beam-type frame provides the backbone for the locking power which renders high injection pressure possible, eliminating flash (which cannot be tolerated in production of combs), and producing strong, homogeneous, stable, smooth-surfaced moldings. The automatic control system is the brain which regulates the molding cycle to the tenth of a second, with exact repetition of mold movement, injection and ejection by means of electric timers. The central mold adjustment by means of a single hand crank is easy to operate and assures constant and absolute parallelism of mold platens—one more guarantee of highly accurate moldings. Heating cylinders are interchangeable, making it possible to increase pressure, quickly and easily, by using a smaller capacity cylinder.

These and other Lester engineering features are available not only in the 4-ounce model, but in the 6, 8, 12, 16 and 22-ounce models as well. Bigger Lester machines, now on the drawing-board, will offer additional advantages to the manufacturer with plastic molding problems.

LEARN MORE ABOUT LESTERS

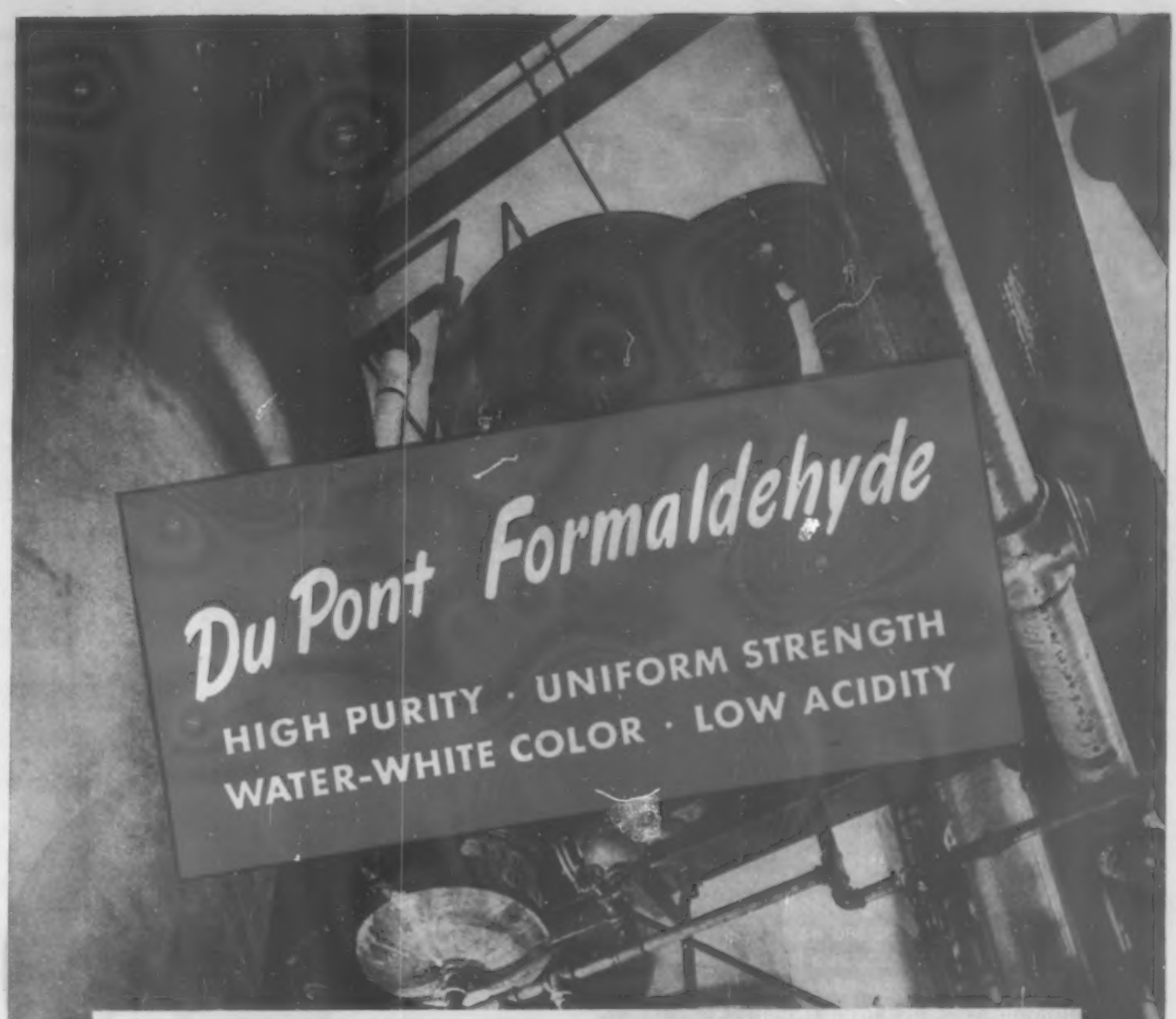
If you are contemplating the purchase of new plastic molding machinery, either now or in the future, we sincerely believe that it will pay you to learn all you can about Lester equipment before buying. We have much interesting literature, including reprints of several informative trade magazine articles, available without charge to engineers and executives. Write TODAY for full data.

INJECTION MOLDING MACHINES

"Shaping the Things of Tomorrow"

National Distributors:

LESTER-PHOENIX, INC., 2711 Church Ave., Cleveland 13, Ohio



DU PONT FORMALDEHYDE is produced under rigid control and supervision. The product is designed to meet the high requirements of the plastics industry.

SHIPMENTS in standard containers are made from the factory or stocks maintained in principal cities.

AVAILABILITY subject to WPB General Allocation Order M-300 Appendix A Materials. Under Schedules 9 and 10, "Small Order Exemptions," 1,500 lbs. of 37% Formaldehyde, 500 lbs. of Paraformaldehyde and 10,000 lbs. of Hexamethylenetetramine can be obtained without application to WPB. Quantities in excess of the above require application on form WPB-2945 (PD600). Filing date is 15th of month preceding month of delivery.

Depend on Du Pont also for: PARAFORMALDEHYDE—powder or granular 95% minimum strength. And HEXAMETHYLENETETRAMINE—U. S. P. crystals or technical. Call our nearest district office for information and technical assistance. Electrochemicals Department, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

District Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City,* New York, Philadelphia, San Francisco. *Barada & Page, Inc.

DU PONT

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

BUY AND HOLD MORE WAR BONDS

DU PONT ELECTROCHEMICALS

IT'S AMAZING WHAT AN
OUNCE OF PLASTIC
CAN BE MADE TO DO!
"New Era"– a La Cross Hand Beauty Aid Ensemble, Manufactured by Schaefel Bros. Corporation, Newark, N. J.
Shown here — approximately actual size — a structural, functional and decorative package component; it was injection molded of acetate and weighs one ounce!
The domed top is designed as a display dias, recessed and walled so as to contain and support a trio of nail-care bottles. Extending down through the center is a fourth recess; this provides an upright arrangement for the orange stick and emery board.
The under surfaces of the dome reveal skilled handling of the mold's construction . . . and provide structural strength without the slightest waste of material.
A repeating pattern of short, slender ridges, positioned just above the beaded edge, serves to grip the cover of the package snugly; prevents the contents from being jarred.
The brilliant, smooth surface of the piece is a molded-in feature. Sterling pre-establishes this type of result in the finish of the mold itself. It eliminates extra polishing operations.
Should you, as was this item's manufacturer, be faced with product problems . . . call upon STERLING to see you through. Inquiries invited!
STERLING PLASTICS CO.
1140 COMMERCE AVENUE, UNION, N. J.

From a strand of
PLEXON to a smart
handbag is a jump
that's all in the day's work
for plastic's newest prodigy.
Manufacturers, stylists,
and industrial designers
are already using this beautiful
plastic-coated yarn in
some amazing ways, but
so far they've only
scratched the surface.
Just drop us
a line if you'd
like to hear more
about it.

Now nationally advertised,
so consumers everywhere are
becoming increasingly
familiar with this tag:

Freydberg Bros. Strauss, Inc.
Plastics Division, New York 10

It's Sensational! . . . Here is the *NEW,*

BONDS ANYTHING

IT'S STRONG
•
IT'S PERMANENT
•
WITHSTANDS CONSTANT FLEXING
•
APPLIES EASILY (one part adhesive)
•
SETS QUICKLY
•
IMMUNE TO FUNGI
•
RESISTS WATER, OILS AND WAX
•
WORKS HOT OR COLD

UNITED STATES PLYWOOD CORPORATION, 55 West 44th Street, New York 18, N. Y.

Please send me a free sample of PLIOBOND.

Name_____ Title_____

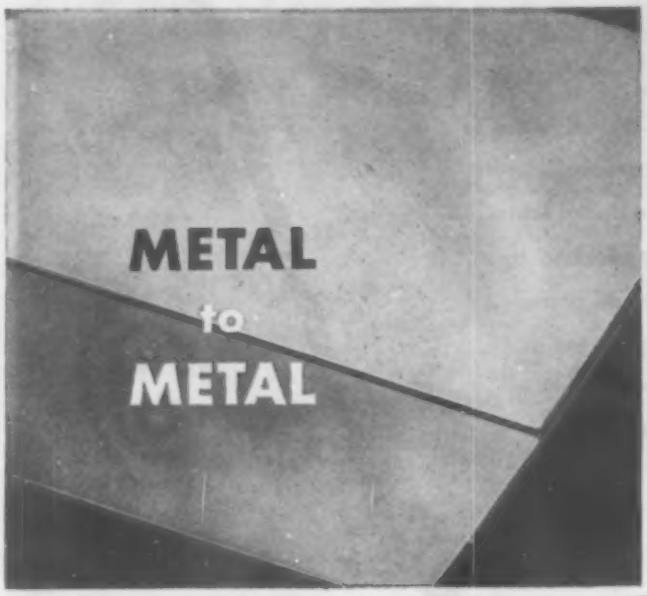
Firm_____ Address_____

MP7-45

TRY A SAMPLE IN YOUR OWN WORK

Quick-Setting Plastic Adhesive that

TO ANYTHING!



Pliobond

—FOR IMPROVED PRODUCTION TECHNIQUES

Pliobond is one of American industry's great wartime achievements, now solving scores of production problems.

An all-purpose plastic adhesive that *simply* and *easily* bonds materials together which have never before been bonded successfully.

Pliobond joins any materials . . . like or unlike . . . metals, plastics, fabrics, glass, rubber, wood, ceramics, paper, leather, plaster, concrete, etc. For most applications, no high pressure or heat is needed. In others, where extremely high shear strength is desired, moderate pressure and 200 – 300° F. will produce a perfect bond.

When you use Pliobond, there's no elaborate procedure involved. It's a *one*-part bonding agent . . . always ready to go to work. No fussy mixtures. No careful weighing. No critical temperatures. It can be brushed, sprayed, spread or roller coated.

Manufacturing facilities for Pliobond are rapidly being increased to meet all demands. For sample and technical information, please use coupon, writing us in detail on any special problems.

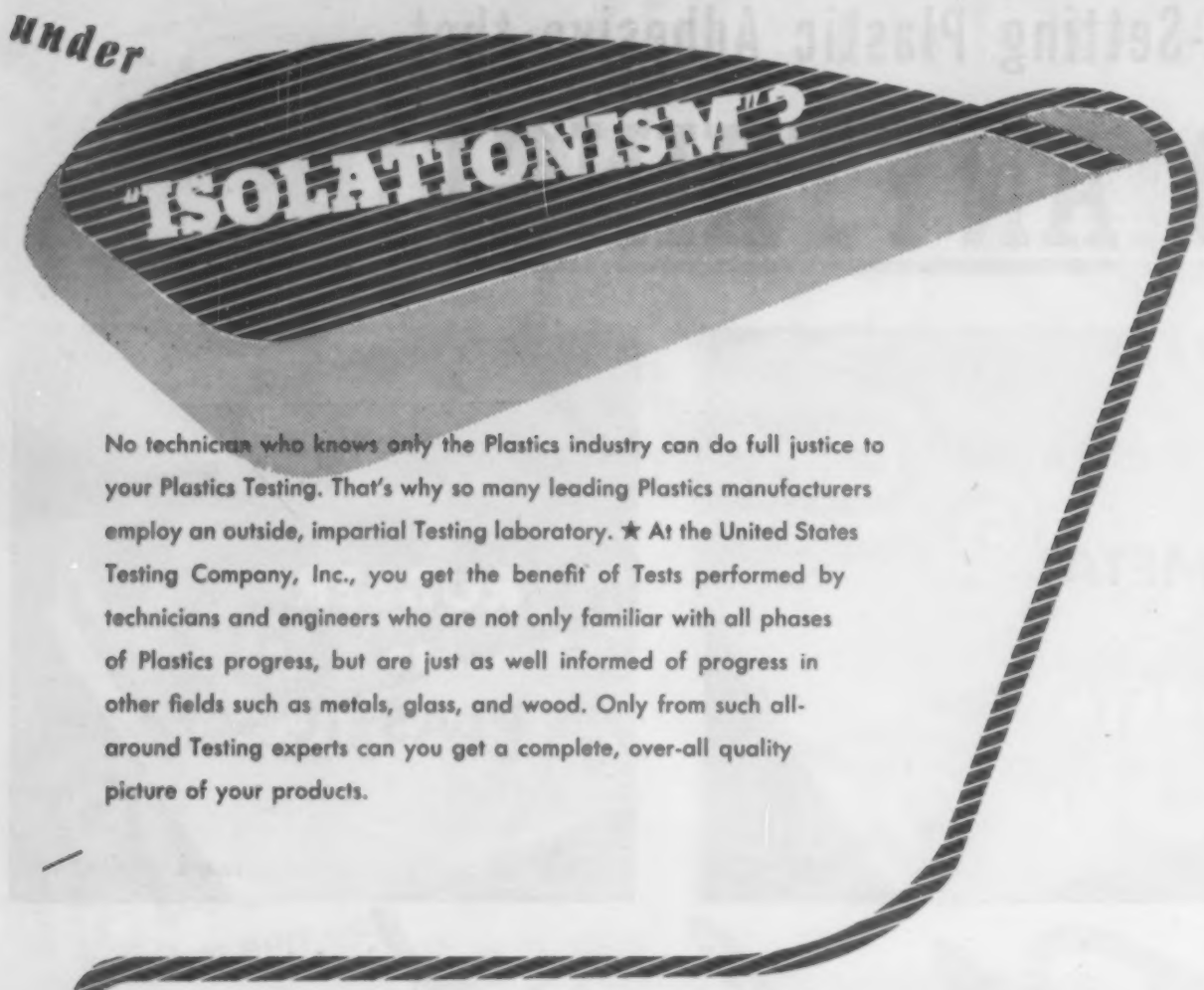
UNITED STATES PLYWOOD CORPORATION EXCLUSIVE DISTRIBUTORS

Industrial Adhesives Division: 55 West 44th Street, New York . . . Branches in principal cities

***Pliobond* is a product of* THE GOODYEAR TIRE & RUBBER COMPANY**

*Trademark registered, The Goodyear Tire & Rubber Company

Is Your Plastics Testing Conducted



No technician who knows only the Plastics industry can do full justice to your Plastics Testing. That's why so many leading Plastics manufacturers employ an outside, impartial Testing laboratory. ★ At the United States Testing Company, Inc., you get the benefit of Tests performed by technicians and engineers who are not only familiar with all phases of Plastics progress, but are just as well informed of progress in other fields such as metals, glass, and wood. Only from such all-around Testing experts can you get a complete, over-all quality picture of your products.

These *Plastics* Tests are but a partial list of our complete service:

STRENGTH TESTS

Impact Charpy or Izod, 5 specimens	$5.00
Tensile, 5 specimens	7.50
A. With Stress, Strain Diagram, 5 specimens	12.00
Flexural, 5 specimens	7.50
A. With Stress, Strain Diagram, 5 specimens	12.00
Compressive, 5 specimens	7.50
A. With Stress, Strain Diagram, 5 specimens	12.00

DIELECTRIC STRENGTH TESTS

Short Time	6.00
Step by Step	10.00

POWER FACTOR AND DIELECTRIC CONSTANT AT 60 CYCLES, 10^3 OR 10^6 CYCLES

Per Frequency	15.00
2nd Sample	12.50
Each Additional Sample	10.00

VOLUME RESISTIVITY—Insulation Resistance	5.00
THERMAL CONDUCTIVITY (Mean Temperature 80 Deg. F.)	25.00
ARC RESISTANCE	6.00

CERTIFIED MERCHANDISE · UNITED STATES TESTING CO. INC. · SEAL OF QUALITY

UNITED STATES TESTING COMPANY, INC.

ESTABLISHED 1880

HOBOKEN, NEW JERSEY

PHILADELPHIA, PA. · BOSTON, MASS. · WOONSOCKET, R. I. · CHICAGO, ILL. · NEW YORK, N. Y.

PANELYTE*

PRECISION-MOLDED FAN BLADES

GIVE YOU THESE 9 ADVANTAGES:

Panelyte Blade (62" long — 14½" wide) mass-produced for Hartzell Propeller Fan Company, Piqua, Ohio, being removed from mold.

1. QUIET OPERATION
2. LIGHT WEIGHT
3. RESISTANCE TO CORROSION
4. LOW MOISTURE ABSORPTION
5. GREAT STRENGTH
6. STABILITY UNDER TEMPERATURE CHANGES
7. LOWER STARTING CURRENT URGE
8. REDUCED BEARING LOADS
9. TROUBLE-FREE PERFORMANCE

Panelyte Fan Blades . . . from midgets 2" long to 62" giants . . . are precision-molded in straight line mass production. The unique combination of properties of these blades makes them ideal for the complete range of applications . . . from household fans, cooling fans in refrigerators and air-conditioning units where quiet operation is a major requirement, to blades such as those supplied for outdoor cooling tower fans and other industrial and domestic uses where resistance to corrosion and extremes of temperature are paramount.

The techniques perfected in the molding of aircraft propeller blades in wartime will produce better *fan blades* for peace time uses.

Panelyte engineers are ready to work with you . . . to discuss the design and mass production of fan blades or other molded or fabricated parts. Write for factual "Data Book."

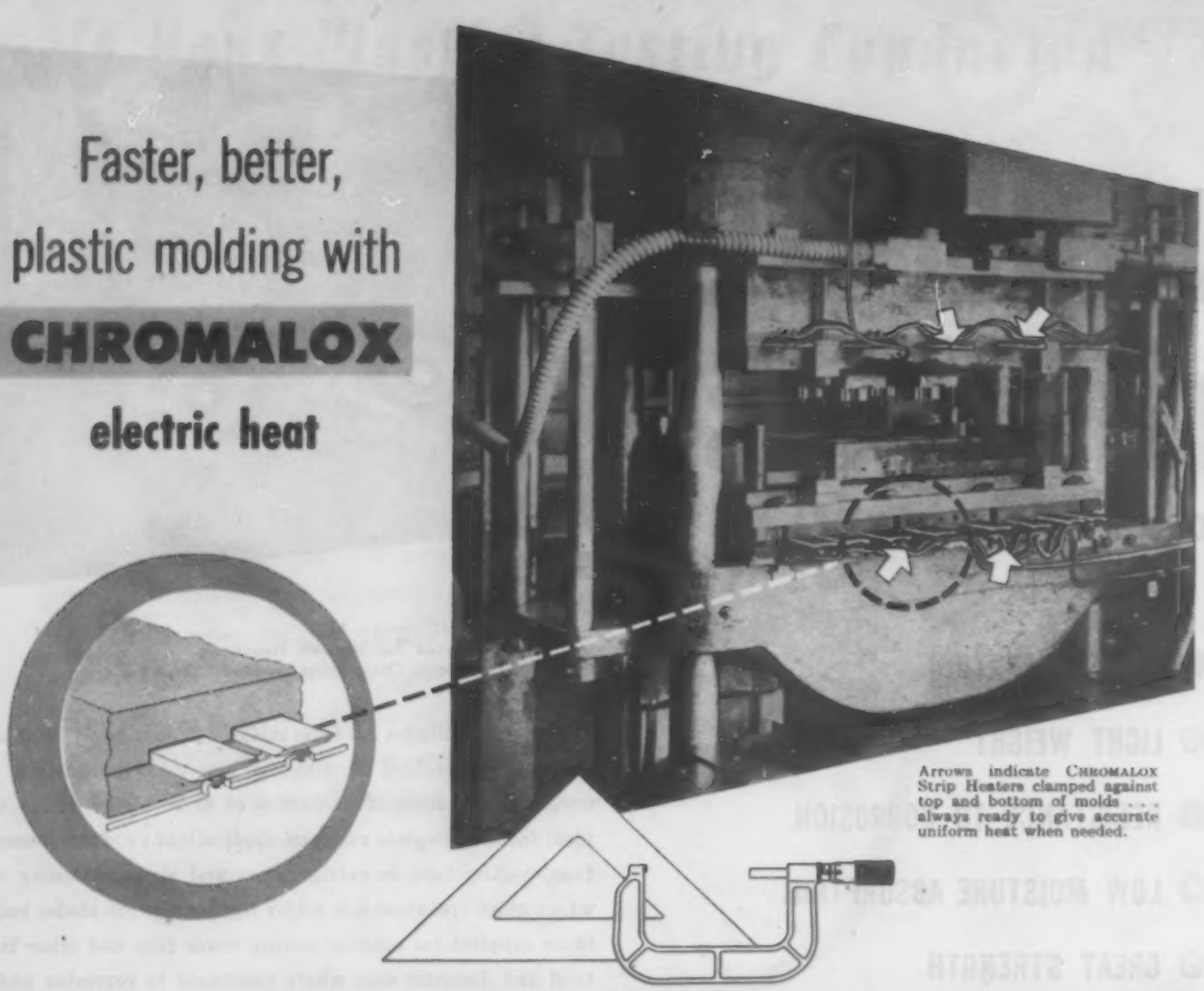
PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Mexico City, Montreal, New Orleans, Phoenix, Portland, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver.

★ MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS IN PAPER, FABRIC, FIBRE GLASS, WOOD VENEER AND ASBESTOS BASE LAMINATES

Faster, better, plastic molding with CHROMALOX electric heat



Arrows indicate CHROMALOX Strip Heaters clamped against top and bottom of molds . . . always ready to give accurate uniform heat when needed.

This 100-ton molding press in a tool manufacturing plant illustrates the practical application of CHROMALOX *Electric* Heaters for the heating of plastic molds.

The CHROMALOX *Electric* Strip Heaters used on this job were easy and economical to install. Heat is obtainable at short notice and thermostatically controlled to any temperature. There is practically no maintenance problem.

When in operation on an 8-hour day, the molds on this press cost only 8.5¢ per hour to heat electrically with CHROMALOX Strip Heaters.

Electric heat is adaptable to all types of molding presses—injection and extrusion . . . and no doubt you have other heating problems too for which CHROMALOX offers the ideal solution. Consult your CHROMALOX Application Engineer. He'll gladly tell you how you can benefit by using electric heat.

Says Factory Manager of Company "X" . . . using this 100-ton press:

"...due to economy of operation, very accurate control of temperature, absolute cleanliness and freedom from humidity we would not consider changing to any other heating method."

IC-6

Send for this booklet

It illustrates many practical examples of the applications of electric heat to industrial use and gives the address of your nearest CHROMALOX Application Engineer.

Edwin L. Wiegand Co.

7503 Thomas Blvd. Pittsburgh 8, Pa.

CHROMALOX — "*Electric* Heating at its Best!"

NEW TELEVISION LENS OF DU PONT

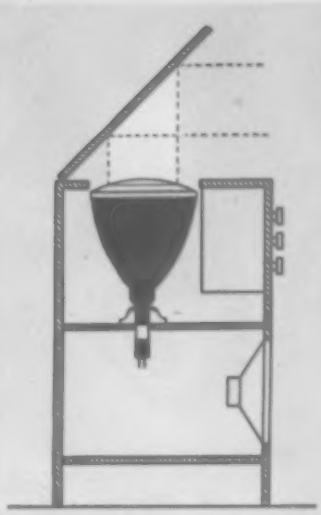
"LUCITE"

Helps bring the new home receiving sets at popular prices . . . with screen images brighter, clearer . . . 5 times larger

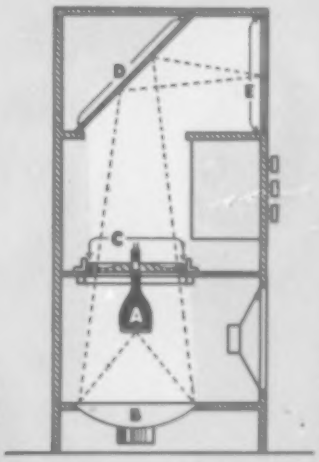
THE TELEVISION SET you will have in your home after the war—it's ready now—will show on a screen a picture big enough to see . . . with ease and without distortion.

The new method "does it with mirrors" . . . adapts a well-known principle of astronomical photography. But while the astronomers need not care too much about the cost, the maker of television sets for millions of average Americans has to care—tremendously. The new method of producing television sets within a popular price range is made possible by the discovery that a basic part—an aspherical correcting lens possessing excellent light-transmission and low-scattering of light properties—can be mass produced from molded "Lucite" methyl methacrylate resin in a matter of minutes. A glass lens of equivalent quality requires days of skilled grinding and polishing.

Although Du Pont "Lucite" is allocated by WPB, experimental quantities for test purposes can be obtained by writing: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J.



THE OLD WAY. Relatively small. With a direct-viewing cathode-ray tube, 12 inches in diameter, the picture you saw in prewar models was about 9 x 7 inches.



THE NEW WAY. Larger, clearer. By reflecting the rays from a spherical mirror (see diagram) and using a correcting lens of "Lucite," a tube only 5 inches in diameter produces an image which fills a screen 21½ x 16 inches, and with greater clarity. The reflective optical system, lens and sets developed by RCA Laboratories to be produced after the war by RCA Victor Div. of the Radio Corp. of America.

This Lens Projection System utilizes a brilliant image on the face of the cathode-ray tube (A) projected down on the spherical glass mirror (B), then reflected up through the "Lucite" correcting lens (C) on a flat mirror (D) which throws a focused image on the translucent viewing screen (E).

FOR PLASTICS . . CONSULT DU PONT

BUY—AND HOLD—WAR BONDS

Keep her in mind . . . because it's good business! For she is your customer of tomorrow . . . who will be responsive to the appeal of Columbia Plastic products so new in shape, in color, in functional design, as to captivate her with their glamour. And Columbia has the vision, the realistic experience, the unrivalled molding facilities to bring these products in unending flow to the new Plastic Age that's just around the corner!

COLUMBIA *Plastics*

COLUMBIA PROTEKTOSITE CO., INC. • CARLSTADT, N. J.

IF IT'S A BETTER PRODUCT GIRAFFE-TER . . .

(Can you name all the plastic parts of this "giraffe"? See chart below.)

Please look closely at this giraffe.

He's a lot more practical and useful than most giraffes. The artist put him together out of nine different plastic items all made by Continental's very busy Plastics Division.

His body is a smart-looking phenolic liquid-dispenser; his neck, two phenolic tractor handles. His head is a handle for an air power drill made of cellulose acetate butyrate, while his hoofs are trim compression-made switch-latches.

These items are just a mere handful of the surprising variety of useful plastic products that Continental makes for well-known industrial concerns — plane parts, cams and cogs, impellers and insulators—all of them the result of Continental combining years of experience with greatly increased production facilities and resources. Such a combination means we can bring to bear on your problems an unusual background of knowledge and experience to help you develop better products.

(a) Liquid-dispenser—compression; (b) Tractor handle—compression; (c) Switch-latch—compression; (d) Water-pump impeller—compression; (e) Handle—compression; (f) Molding—extrusion; (g) Pot handle—compression; (h) Knob—compression; (i) Handle for air power drill—injection.

Tune in: "REPORT TO THE NATION" every Sunday over coast-to-coast CBS network

CONTINENTAL PLASTICS DIVISION

CAN COMPANY, INC.

HEADQUARTERS: Cambridge, Ohio

Sales Representatives in all Principal Cities

COMPRESSION • INJECTION • EXTRUSION
SHEET FORMING • LAMINATION

Other Continental Products: Metal Containers • Fibre Drums • Paper Containers • Paper Cups • Plastic Products • Crown Caps and Cork Products • Machinery and Equipment.

DUPLICATING A GERMAN VACUUM TUBE IN 3 DAYS

Just behind the battlefront, a telephone system lay dead. The retreating enemy, hoping to return, had not blown it up, but had taken with them its vacuum tubes. To put it back to work, the General ordered 1000 new tubes — spot delivery.

A sample tube was flown back to the United States and brought to Bell Telephone Laboratories. It was of German design, different from any American tube in both dimensions and characteristics. Could it be duplicated soon? The job looked feasible. Within three days, try-out models were on their way to Europe. Three weeks later, Western Electric Company had made and delivered every tube. They were plugged in; vital communications sprang to life.

Vacuum tubes are an old story for Bell Laboratories scientists. Back in 1912 they made the first effective high vacuum tube. Three years later, they demonstrated the practical possibilities of tubes by making the first radio talk across the Atlantic, pointing the way to radio broadcasting. Since then, they have developed and utilized the vacuum tube wherever it promises better telephone communication — there are more than a million in your Bell Telephone System.

Today, Bell Telephone Laboratories is solving many of the toughest tube problems faced by the Armed Forces. When the war is over, it goes back to its regular job—keeping American telephone service the best in the world.

• This electrical replica of a heater-type pentode was made for use in German telephone repeaters.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for our Armed Forces at war, and for continued improvements and economies in telephone service.

TOO HOT to handle? Not a bit. The hot fuel container in this Justrite Soldering Torch is made of metal and often reaches a temperature of 600° F. But the plastic handle which encloses it never gets too hot no matter how long the torch is burned.

The housing and base were designed and molded of a phenolic material by CMPC. A narrow air space is provided between the plastic housing and the metal fuel container. Result, a light weight housing that provides ample heat insulation . . . never too hot to handle.

Simple, when you analyze it. Yet it demonstrates the ability of CMPC to tackle most any type of plastics molding problem and come up with the right answer. So . . . remember . . . don't say it can't be done with molded plastics. Maybe it can . . . and better. A good way to find out is to ask for the services of a CMPC Development Engineer. Your request incurs no obligation.

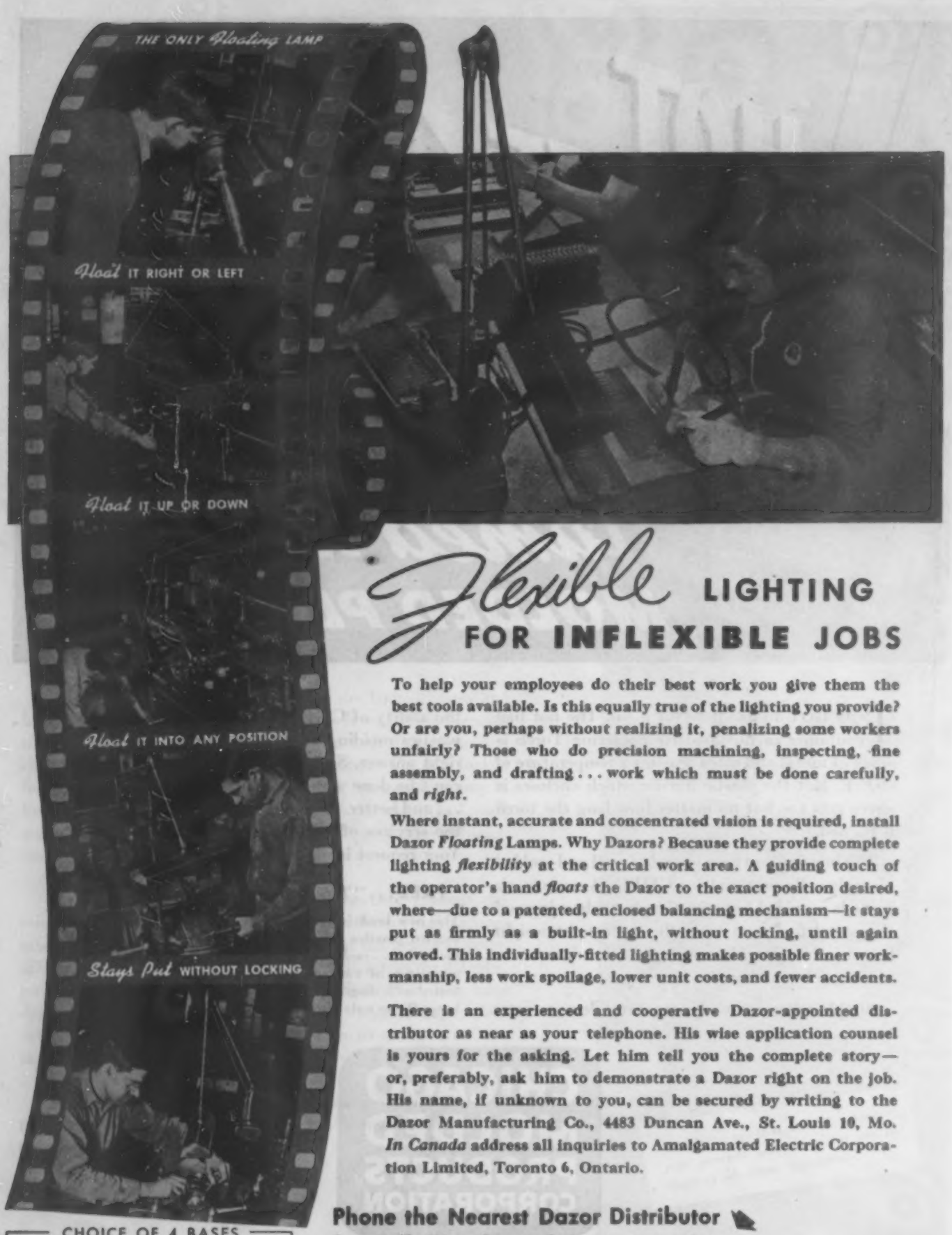
FREE . . . *"The Story of Plastic Molding"*

This new book is brim-full of valuable information about molded plastics . . . pointers on designing . . . molding methods . . . mold making. Gives, in chart form, the characteristics of various molding materials. Profusely illustrated with diagrams and photos . . . a book you'll want to keep. Write today on your company letterhead.

CHICAGO MOLDED PRODUCTS CORPORATION

1046 N. Kolmar Ave. Chicago 51, Illinois

COMPRESSION AND INJECTION MOLDING OF ALL PLASTIC MATERIALS

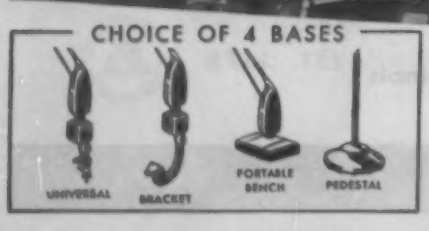


Flexible LIGHTING FOR INFLEXIBLE JOBS

To help your employees do their best work you give them the best tools available. Is this equally true of the lighting you provide? Or are you, perhaps without realizing it, penalizing some workers unfairly? Those who do precision machining, inspecting, fine assembly, and drafting . . . work which must be done carefully, and *right*.

Where instant, accurate and concentrated vision is required, install Dazor *Floating* Lamps. Why Dazors? Because they provide complete lighting *flexibility* at the critical work area. A guiding touch of the operator's hand *floats* the Dazor to the exact position desired, where—due to a patented, enclosed balancing mechanism—it stays put as firmly as a built-in light, without locking, until again moved. This individually-fitted lighting makes possible finer workmanship, less work spoilage, lower unit costs, and fewer accidents.

There is an experienced and cooperative Dazor-appointed distributor as near as your telephone. His wise application counsel is yours for the asking. Let him tell you the complete story—or, preferably, ask him to demonstrate a Dazor right on the job. His name, if unknown to you, can be secured by writing to the Dazor Manufacturing Co., 4483 Duncan Ave., St. Louis 10, Mo. *In Canada* address all inquiries to Amalgamated Electric Corporation Limited, Toronto 6, Ontario.



Phone the Nearest Dazor Distributor for Full Details and Demonstration

DAZOR *Floating* LAMPS

FLUORESCENT *and* INCANDESCENT

FOR YOUR POSTWAR DESIGNS —

PLEXIGLAS

— the plastic that complements light

You can choose no more effective medium than clear, lustrous PLEXIGLAS *for the distinctive base designs that will grace your postwar lamps. Not only has* PLEXIGLAS *a sparkle all its own; it also is a natural partner of light . . . actually catching and reflecting rays from nearby light sources.*

Of special interest, too, are these additional features of PLEXIGLAS: *excellent electrical and thermal properties, strength, ease of fabrication and molding.*

For that new note of distinction on your postwar products, remember to specify PLEXIGLAS. *For detailed information write our nearest office: Philadelphia, Los Angeles, Detroit, Chicago, Cleveland, New York. Canadian Distributor: Hobbs Glass Ltd., Montreal.*

● *Fine examples of the design possibilities of* PLEXIGLAS *are these two lamps by Wm. Van Cleff, New York. They show how* PLEXIGLAS *can easily be formed to shapes which bring luster and lively sparkle to the bases.*

ONLY ROHM & HAAS MAKES **PLEXIGLAS** CRYSTAL-CLEAR ACRYLIC SHEETS AND MOLDING POWDERS

PLEXIGLAS *is the trade-mark, Reg. U. S. Pat. Off., for the acrylic resin thermoplastic sheets, rods and molding powders manufactured by Rohm & Haas Company.*
Represented by Cia. Rohm y Haas, S.R.L., Carlos Pellegrini 331, Buenos Aires, Argentina, and agents in principal South American cities.

ROHM & HAAS COMPANY

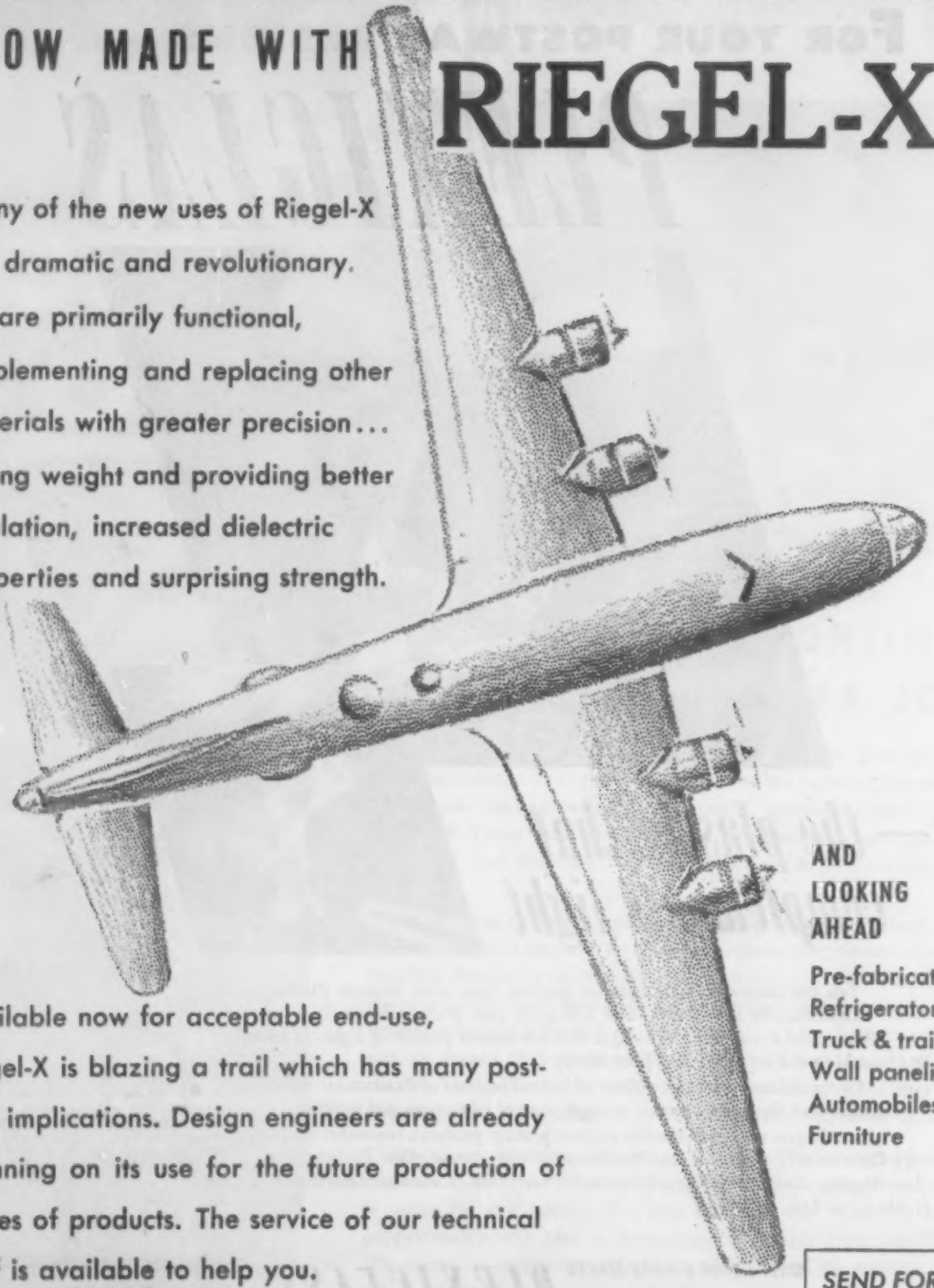
WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Manufacturers of Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile, Enamelware, Rubber and other Industries

AUXILIARY and JETTISON GAS TANKS

NOW MADE WITH RIEGEL-X

Many of the new uses of Riegel-X are dramatic and revolutionary. All are primarily functional, supplementing and replacing other materials with greater precision... saving weight and providing better insulation, increased dielectric properties and surprising strength.



Available now for acceptable end-use, Riegel-X is blazing a trail which has many post-war implications. Design engineers are already planning on its use for the future production of scores of products. The service of our technical staff is available to help you.

AND LOOKING AHEAD

Pre-fabricated homes
Refrigerators
Truck & trailer bodies
Wall paneling
Automobiles
Furniture

RIEGEL PAPER CORP., 342 MADISON AVE., N. Y. 17, N. Y.

SEND FOR the new Riegel Bulletin on Papers for the Plastics Industry

RIEGEL-X

x A group of plain and impregnated base papers for high or low pressure laminates x

WHETHER YOU NEED
PLASTIC PARTS
FOR ELECTRICAL APPLIANCES
OFFICE MACHINES OR INDUSTRIAL EQUIPMENT
Special Handles and Control Knobs for
TOOLS RADIOS AUTOS PLANES
CASES FOR CLOCKS CAMERAS JEWELRY
BATHROOM FIXTURES MEDICAL ACCESSORIES
Or Anything Else that's a Practical Plastic Application
You Get the Job Done Right by

Amos
MOLDED PLASTICS...

CUSTOM Molders of
Plastic Parts and Products
INJECTION • COMPRESSION

It takes experience, skill and the right equipment to engineer and mold an attractive, perfect-fitting plastic frame for a fine pocketbook—or a beautiful plastic compact—like you see above. Amos has what it takes to do these and numerous other jobs exactly right—the way the customer wants them.

From engineering to finishing, Amos does plastic molding jobs that go into many different fields. Whether it be a large or small component part for some machine or appliance—or an all-plastic product—Amos does the job completely—*and does it right.*

Amos facilities are being greatly expanded. A new plant is about to be completed and equipped to take care of more customers who want their post-war plastic molding jobs done right. Now's the time to get your jobs ready for fast production when materials are available. Just send us your drawings or write us what you have in mind to be molded in plastics.

AMOS MOLDED PLASTICS • EDINBURGH, INDIANA
Division of Amos-Thompson Corporation

FROM LABORATORY MIDGET TO PRODUCTION GIANT—

F-B CALENDER DESIGN FITS THE JOB

HERE is an illustration of the wide range of sizes of Farrel-Birmingham Plastics Calenders. From the 8" x 16" laboratory size to the huge 32" x 70" production machine, the physical proportions, materials, type of construction, lubricating system, gearing, special operating features—in fact, every vital detail is designed to fit the job the calender is built to do.

Here, in part, is how this principle is carried out in the units shown:

THE 32" x 70" FOUR-ROLL PRODUCTION SIZE CALENDER

Built for close control of gauge in producing vinylite sheet, this calender has individual motors for each screw of the top, bottom and side rolls. This means that a screw can be operated independently to adjust one end of a roll, but can also be synchronized with the one at the other end for parallel adjustment. Chilled iron rolls, carefully ground and chamber-bored for steam circulation, are carried in full bronze-lined journal boxes. The housings and other parts are proportioned in size and weight to the large rolls, which offer more than three times the resistance to deflection ordinarily provided. Effective lubricating systems for the various moving parts contribute to higher operating efficiency, reduced maintenance and longer life.

THE 8" x 16" FOUR-ROLL LABORATORY SIZE CALENDER

Designed for experimentation and for small production of plastic stocks, this unit is entirely self-contained, the drive being enclosed inside the base on which the calender is mounted. Journal boxes are flood-lubricated, with circulating pump, oil cooler and oil sump tank mounted in the base. An adjustable speed motor provides the optimum operating speed for any individual stock.

Write for further information regarding calenders or any of the other equipment listed on this page.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONN.
Plants: Ansonia, Derby and Stonington, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles, Tulsa, Houston, Charlotte

F-B PLASTICS MACHINERY

Banbury Internal Mixers — Roll Mills
Converting, Mixing and Sheeting Rolls
Calenders — Extruding Machines
Hydraulic Presses — Hydraulic Accumulators
Sheet Cutters or Planers

Farrel-Birmingham

PLENTY Rugged

The handle of this Ka-Bar Rigging Knife was molded by Mills for the Union Cutlery Company, Olean, N. Y.

"Rugged" is the terse way our fighting men describe anything difficult, strong, challenging, or tough and enduring. "Rugged" in the latter sense well describes the handle molded by Mills for this Ka-Bar Rigging Knife. It has to be rugged to stand the hard use to which it is put by the men of our Navy, Coast Guard and Merchant Marine. This handle typifies one phase of Mills' molding versatility. . . . it's simple in design yet carefully molded for a rugged job. But whether products call for the simplest or most complex form of injection or extrusion, they are treated with equal care by Mills' engineers and craftsmen. So, if you are planning the use of plastics in your peacetime products, bring them to us. You may be sure that they will be handled with knowing care.

Write on your letterhead for the new Injection Molded and Extruded Plastic Catalog. Or, for detailed information about MILLS PLASTIC* pipe, tubing and fittings, write for circulars containing data and illustrations.

*Trademark Reg.

ELMER E. MILLS CORPORATION

Molders of Tenite, Lumarith, Plastacele, Fibestos, Lucite, Crystallite, Polystyrene, Styron, Lustron, Loalin, Vinylite, Geon, MILLS PLASTIC,* Saran and Other Thermoplastic Materials

153 WEST HURON STREET • CHICAGO 10, ILLINOIS

PENACOLITE

is a war ~~baby~~ ADULT

War baby? It would be more correct to say war adult.

Formed in 1941 as a separate division to develop and exploit findings in resorcin research conducted under the auspices of the Pennsylvania Coal Products Company, PENACOLITE, since that time, has been going like a pre-war house of untreated wood on fire.

Army and Navy product development, and the adhesive problems and operating "bugs" of private firms seeking solutions served as the catalyst. Through them PENACOLITE compounded its research background with rapidly accumulating experience and technical know-how to become the producer of resin adhesives of unparalleled performance.

But that's not all! Like the polymerizing molecules it manipulates, PENACOLITE has gone further. Resins, adhesives, and coatings were just the beginning. In the hopper now—in the laboratory and "pilot plant" stage—are innovations that, with some exaggeration, will take a man's hat off at fifty paces.

These new products, new developments, will be announced when they are perfected and tested to the standard of quality and performance you've come to know as PENACOLITE. In the meantime, G-1124 and G-1131 will still be the best performing resin adhesives.

PENNSYLVANIA COAL PRODUCTS COMPANY

PETROLIA, PENNSYLVANIA • 55 West 42 St., New York 18, N. Y.

Dutton ECONOTHERM
AUTOMATIC STEAM GENERATOR

... as complete as that!

Ready to set down in your boiler room and run! The Dutton Econotherm is a completely self contained "plug in" job with all controls wired and all piping complete — the only installation costs are connecting fuel, water and steam lines; a saving of at least 20%. The ultimate in automatic "packaged" steam generation — backed by our 65 years experience.

Ingenious Dutton controls automatically regulate every function of the generator, constantly making adjustments to insure efficient, clean and economical operation. Supervision and maintenance costs are almost negligible.

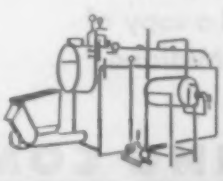
The exclusive Dutton design of rotary combustion, three pass heating and induced draft system give unexcelled performance through increased firing rate, quicker steaming, uniform circulation and meets maximum steam demands without variation in pressure or changes in water level. All gases scavenged — no chimney necessary other than small pipe to carry flue gases through roof.

Either gas or oil fired — 80% efficiency guaranteed. All capacities up to 150 H.P.

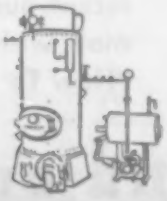
Our engineers will be glad to analyze your requirements and make sound recommendations.

WRITE FOR FULL DETAILS

DUTTON ECONOMIST
HIGH PRESSURE BOILERS



Dutton



DUTTON AUTOMATIC
VERTICAL BOILERS

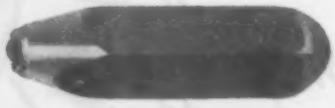
PRESSURE VESSELS • HEAT EXCHANGERS • CONDENSERS

THE C. H. DUTTON COMPANY • 618 GIBSON STREET • KALAMAZOO, MICHIGAN

Free TO USERS OF Hobbed Cavities by Midland

HERE IS AN OFFER OF TWO VALUABLE HELPS FOR USERS OF HOBBED CAVITIES BY MIDLAND . . . A STEEL STAMP FOR POSITIVE IDENTIFICATION OF EACH HOBBED CAVITY, AND A BOOKLET ON HEAT TREATING.

1 **STEEL STAMP**—Midland's trade mark is stamped on every hobbed cavity before shipment. However, when an unfinished block is machined the trade mark is removed. A steel stamp offered to you free by Midland enables you to replace this important identification and so assure recommended heat treatment.



2 **HOW TO HEAT TREAT HOBBED CAVITIES**—This new booklet gives in detail the heat treating procedure developed and recommended by our metallurgists for Hobbed Cavities by Midland. Follow this procedure in your shop—ask your heat treater to follow it—and be rewarded by long and economical production of precision parts.

Write today, referring by order number to your most recent purchase from us. You will receive by return mail, without obligation, a steel stamp and a copy of "How To Heat Treat Hobbed Cavities by Midland."

Midland DIE AND ENGRAVING COMPANY

1800 W. BERENICE AVENUE

CHICAGO 13, ILLINOIS

WHY IS CELLULOSE NITRATE PREFERRED FOR TOOL HANDLES?

Tools are made to be used . . . and a plastic screw driver handle or mallet head has to be tough. You should be able to hammer it, drop it, leave it out all night in the rain or snow . . . all without affecting its usefulness. You can do that with cellulose nitrate . . . the plastic material which for over 75 years has been proving its worth in many fields of application.

Cellulose nitrate (NIXON C/N) is available for use in sheets, rods, tubes, and extruded shapes . . . in colors to match your samples . . . and in pleasing variegated color effects. It is easily worked and machined without loss of dimensional stability. It is a tough, practical material to use for many purposes.

NIXON Plastics

NIXON C/N
Cellulose Nitrate

NIXON C/A
Cellulose Acetate

NIXON E/C
Ethyl Cellulose

NIXON NITRATION WORKS · NIXON · NEW JERSEY

REPRESENTATIVES:
New York • Chicago • Detroit • Saint Louis • Leominster

SALES AGENTS:
NORTHWEST PLASTICS INDUSTRIES
921 Terminal Sales Bldg., Portland, Oregon • 415 Fourth Cherry Bldg., Seattle, Washington

HOBBS GLASS, LTD., Canadian Distributors
Quebec • Montreal • Ottawa • Toronto • Hamilton • Brantford • London
Windsor • Winnipeg • Moose Jaw • Saskatoon • Vancouver • Victoria

"All cats are not gray AT NIGHT"

Over and over again we've been able to disprove that old adage that "all cats are gray at night." Many manufacturers applied this old saying to organizations such as ours . . . until they took us up on our offer to help solve their resin problems. Then . . . they found the Varcum organization truly different!

This is an aggressive, modern-thinking concern and the fresh, uninhibited approach of our Research Staff to knotty phenolic resin problems has greatly impressed manufacturers of brake linings, grinding wheels, impregnated paper and wood products, etc.

IF YOU HAVE A PHENOLIC RESIN PROBLEM . . . WE BELIEVE WE CAN HELP YOU! The research work will cost you nothing.

Drop us a line, fully outlining your resin troubles, and let us get started on them today. We know you'll be mighty pleased with the result. Address your letter to the Research Department.

VARCUM
CHEMICAL CORPORATION
NIAGARA FALLS, NEW YORK

PEACE WORK

BUY WAR BONDS

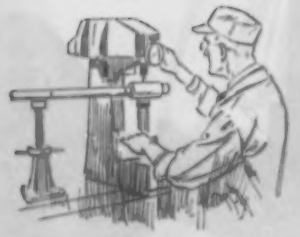
★ ★ ★ These two articles are known to the Army and Navy as parts vitally essential to the breech mechanisms of guns. But manufacturers of peacetime products will do well to note them as excellent examples of the fine precision workmanship that goes into all tools, dies, jigs, fixtures, plastic molds, hardened and precision ground parts, cold forgings, cap screws, bolts, etc., and special equipment that Allied makes *in great quantity*. Uniquely comprehensive experience and superlative equipment and facilities make Allied a dependable source of supply for the automotive, radio, home appliance, plastic, aviation, furniture, electrical, farm implement and many other mass production industries. Allied products may solve some of your mass production "peace work" problems. Send in your blueprints or write—today.

ALLIED PRODUCTS CORPORATION

Department 25
4622 Lawton Avenue
Detroit 8, Michigan

Testing Saddle Cross Slide Dovetail for Squareness with Lathe Bed Ways.

PRECISION IS *Built In* IN SOUTH BEND LATHES



Testing the Hardness of a Carburized Headstock Spindle Bearing Surface.

Checking a Fixture with Precision Gauges.

Inspecting Form and Lead of a Screw Thread with an Optical Comparator.

The "built-in" precision of South Bend Lathes, so evident in their performance, has its source not only in their design features, but in every vital part. Each part has behind it the experience of thirty-eight years of lathe building, plus constant research directed towards its improvement. Backing this up in every manufacturing process are rigid controls that prevent deviations from established standards. These are a few of the reasons why South Bend Lathes are better today in every way.

This "built-in" precision makes possible heavier cuts and feeds, easier operation, longer life, and greater accuracy. It pays dividends to the users of these lathes in better and faster machining. Examine your metal working requirements in view of the advantages that can be obtained through the use of South Bend Lathes.

Write for NEW LATHE CATALOG 100-D

Illustrates and describes all South Bend Lathes. Engine Lathes and Toolroom Lathes with 9", 10", 13", 14½", and 16" swings. Precision Turret Lathes with ½" and 1" collet capacities.

SOUTH BEND LATHE WORKS

443 EAST MADISON STREET • SOUTH BEND 22, INDIANA

LATHE BUILDERS FOR 38 YEARS

7 Reasons why Monsanto is a "Specialist in Plastics for Electronics"

	Loss Factor at 1 Mc.	Heat Distortion Point °F.	Water Absorption 24 Hrs. %	Arc Resistance	Mechanical Characteristics
STYRAMIC HT	0.0005	236	0.03	*	hard
STYRAMIC	0.0008	184-187	0.046	*	hard-rigid
CEREX X-214	0.0066	235	0.30	70 sec.	hard-tough
LUSTRON	0.0007	168-176	0.05	120 sec.	hard-strong
RESINOX 7934	0.0361	255	0.030	6 sec.	hard-rigid
RESIMENE 803-A	0.2820	300	0.51	125 sec.	hard-tough
THALID X-5265	0.078	160	0.20	125 sec.	hard-tough

...completely reactive thermosetting resin for impression molding. Impregnates glass cloth, other fabrics or paper to make large, rigid panels or fully integrated forms of high strength. Ideal for housings, chassis or structural parts of electronic equipment. (Send for descriptive bulletin.)

**Standard ASTM tests are not applicable to these products. D495-42 tests give values ranging from 4-120 sec.*

Heat resistance, loss factor, water absorption, mechanical properties and cost are characteristics considered by the electronic engineer in every application of insulating materials. His choice depends on a balance of the properties for the *specific* use. Monsanto Plastics, offer him a range of materials, one of which will meet virtually every set of requirements.

Monsanto plastics researchers have long devoted a large part of their efforts to the development of plastics for electrical, radio and electronic applications of all kinds. The result is that today Monsanto has become known as a "specialist in plastics for electronics," and is producing tons of these special plastics for applications in this field alone.

An abbreviated performance chart of seven Monsanto plastics used most today in electronics appears herewith. For complete information on these or other Monsanto plastics, or for expert assistance in adapting plastics to your electronic problem, write, wire, or phone: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

MONSANTO PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

The broad and versatile family of Monsanto Plastics includes: Lustron polystyrenes • Cerex heat resistant thermoplastics • Vinyl acetals • Nitron cellulose nitrates • Fibestos cellulose acetates • Resinox phenolics • Resimene melamines • Thalid for impression molding • Forms in which they are supplied includes: Sheets • Rods • Tubes • Molding Compounds • Industrial Resins • Coating Compounds Vuepak rigid, transparent packaging materials.

LET US DEMONSTRATE WHAT ELECTRONIC HEATING can do for YOU

PROOF BY TRIAL . . . that's our motto. Before you invest in electronic heating equipment you should be shown how any process requiring heat can be done *better, faster* and *more economically* for you with a Scientific Electric unit.

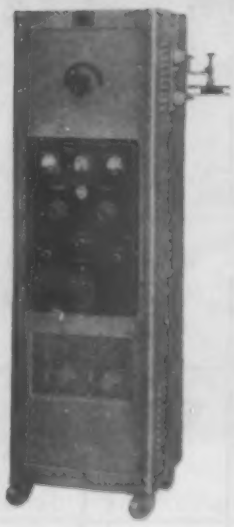
Our engineers will gladly—*without obligation*—make a study of the heating process under consideration. They will then make recommendations supported by practical demonstrations on the S.E. heater best suited for the job.

This procedure will enable you to figure accurately the economies that will result; also permit you to estimate the time required to pay for the equipment out of resultant savings.

You can submit your heating problems to us with the assurance that absolute secrecy will be observed, if so desired. Investigate the advantages of applying electronic heating in your manufacturing operations NOW. Consult with us at your earliest opportunity.

Write for free copy of
The ABC of Electronic Heating

Manufacturers of
Vacuum Tube and Spark Gap Converters Since 1921



3 KW DIELECTRIC HEATER
Dielectric Heating Units priced from **$1500.**
(3 KW complete)

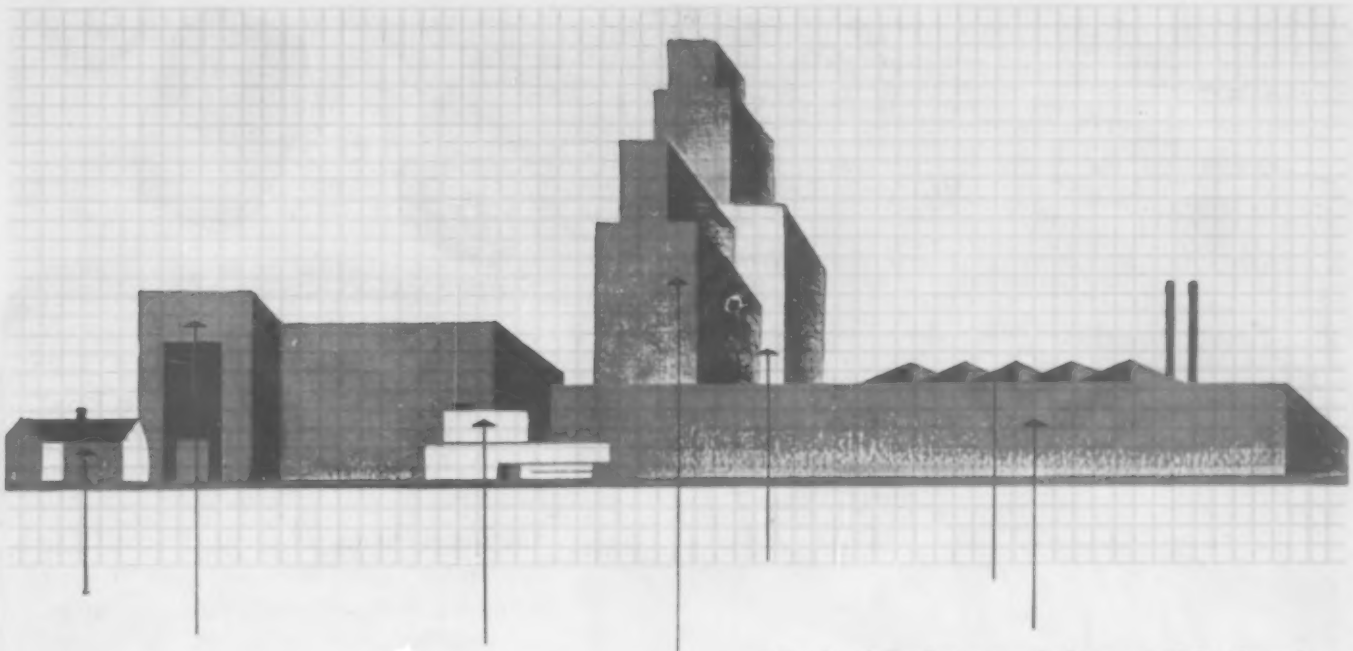
5 KW INDUCTION HEATER
Induction Heating Units priced from **$1285.**
(for 5 KW complete with 1 work coil)

Scientific Electric

DIVISION OF "S" CORRUGATED QUENCHED GAP COMPANY

119 MONROE ST. GARFIELD, N. J.

Scientific Electric Electronic Heaters are made in the following range of power; 3—5—7½—8—10—12½—15—18—25—40—60—80—100—250 KW. — and range of frequency up to 300 Megacycles depending on power required.



SARAN

first plastic screen

first in performance

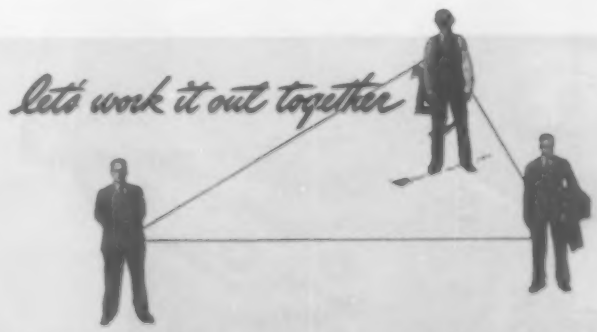
Final and conclusive proof of any material is dependent upon actual service. Screen from Saran—first of its type to be introduced to industry—is head and shoulders above any similar product because it is the *only* plastic screen with a long performance record . . . it has been thoroughly tested by exposure under all possible service conditions . . . in buildings throughout this country and in humid Pacific battle areas—toughest of all testing grounds for any screen.

Why has its record been phenomenal? Saran makes the difference—the Dow plastic from which this great screen is made. More than any other plastic, Saran defies moisture—malicious enemy of screening. Saran actually defies rust—shrugs off dampness, cold, snow, smoke fumes—even salt air. Saran is tough—resists sagging or breaking. It is light—easy to handle and put up. And Saran doesn't require painting—if it gets dirty, restore its appearance with a damp cloth.

Screen is one of many products made from Saran—these products cover the waterfront . . . from fabrics to bottles to pipe and tubing. Why not investigate Saran's possibilities?

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York · Boston · Philadelphia · Washington · Cleveland · Detroit
Chicago · St. Louis · Houston · San Francisco · Los Angeles · Seattle



Success in plastics is not a one-man or even a one-industry job. It calls for the combined skill and experience of manufacturer or designer plus fabricator plus raw materials producer. Working together, this team saves time and money and puts plastics to work successfully. Call us—we'll do our part.

DOW

PLASTICS

STYRON • STRYALOY • ETHOCEL • ETHOCEL SHEETING
SARAN • SARAN FILM • STRIPCOAT

Announcing
STOKES 150-TON
COMPLETELY AUTOMATIC
CLOSURE PRESS

More closures . . . of larger size . . . at lower cost. That's what this new Stokes Completely Automatic Press will do for closure manufacturers.

The Stokes 150-ton press is ideal for molding closures or similar threaded parts in great quantities. It is fully automatic in operation, self-contained, easy to install, set up and change over. Performs all steps of the molding cycle including loading, unscrewing and ejecting — all in 10 to 15 seconds. Curing time varies with size of cap and material. One operator tends a whole battery of presses.

Molding material is saved . . . flash losses reduced. Caps are of uniform high quality and correct density, without "shorts", checking or discoloration.

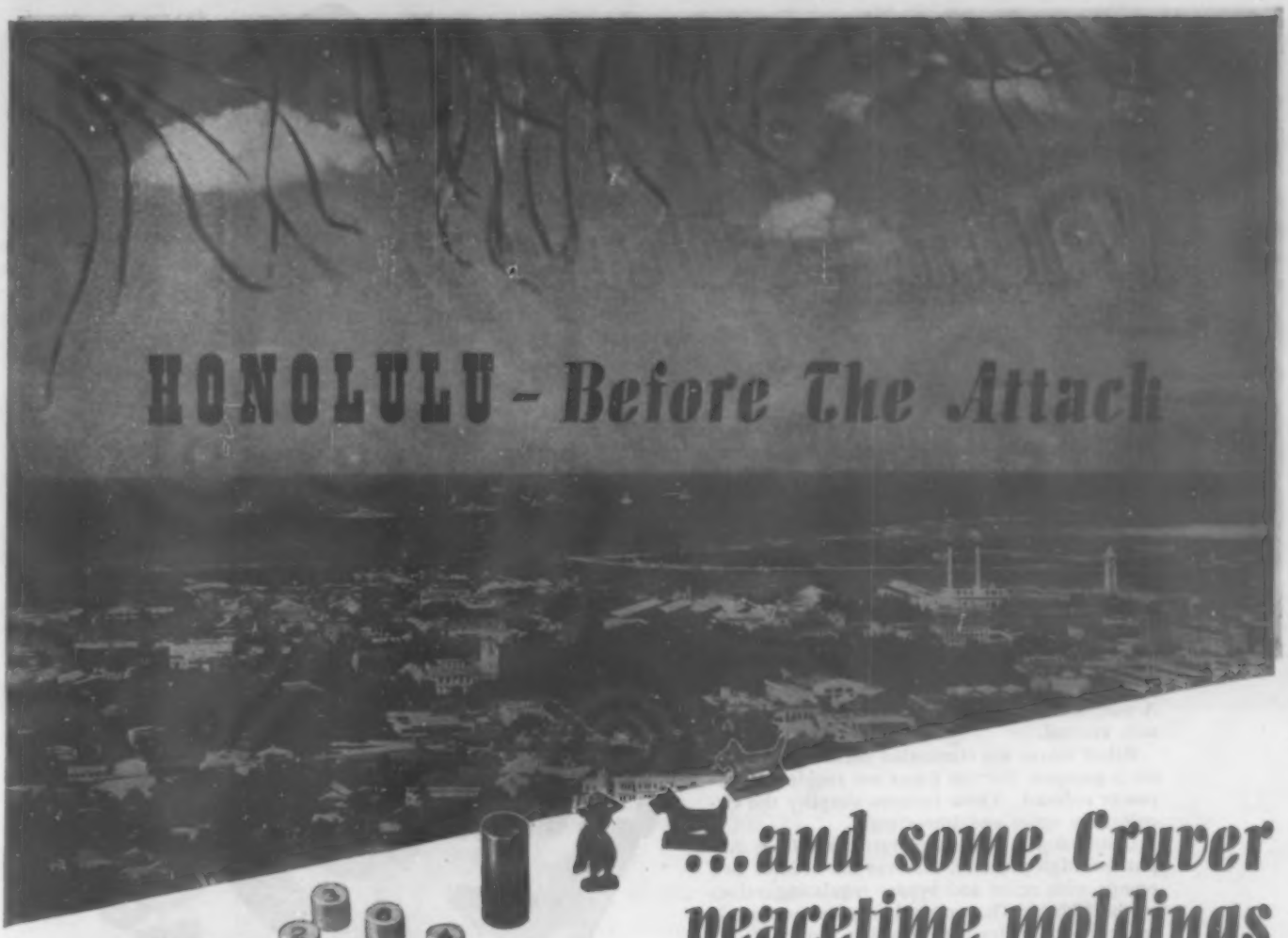
Investigate the competitive advantage possible with this new press. Write for full details.

F. J. STOKES MACHINE CO.
5934 Tabor Road Philadelphia 20, Pa.

50th year of Service to Industry

F.J.Stokes MOLDING EQUIPMENT

FJS Est. 1895



...and some Cruver peacetime moldings

These are some of the custom injection moldings which CRUVER was manufacturing several months before the attack on Pearl Harbor. The automobile horn button and the hand mirror are representative of CRUVER'S unique bas-relief color process, applied to transparent moldings. The small charms, the lipstick case, the adding-machine keys, the sombrero lapel ornament and the large compact are other typical CRUVER peacetime jobs. The playing card is from a CRUVER deck.

We reproduce them along with the picture of peaceful Honolulu as symbolic of the type of work we expect to be doing when the war is over. For these and many other unique moldings, come to CRUVER—headquarters for creative injection molding of thermoplastic materials.

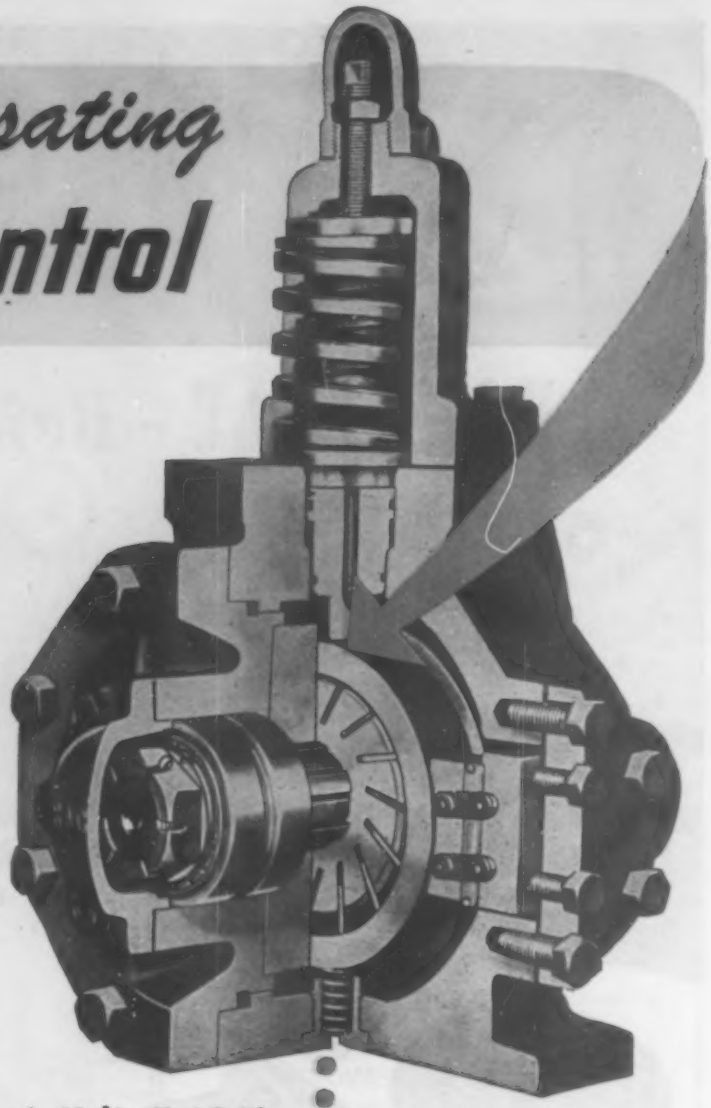
Cruver

MANUFACTURING COMPANY

2456 W. Jackson Blvd. • CHICAGO, ILL. • Seeley 1300

NEW YORK	WASHINGTON	DETROIT
2 WEST 46th ST.	HOTEL WASHINGTON	GENERAL MOTORS BLDG.
Wisconsin 7-8847	Met. 5-900 Ext. 650	Madison 8263

Self Compensating Volume Control



Automatically delivers from zero to full pump capacity

THE FLEXIBILITY of your oil hydraulic circuits can be increased with a "Variable Volume" Pump. RACINE Pumps automatically vary their pumping output to meet the demands of the job. A simple screw adjustment also provides pressure control.

Relief valves are eliminated because no excess oil is pumped. Friction losses are avoided, horsepower reduced. These features simplify the circuit, save space and lower costs.

Combining in one pump, variable volume output and high pressure, removes the need of two pumps with relief and bypass regulating valves in the circuit. The original installation cost is reduced—more flexible operation results.

RACINE's "Variable Volume" Pumps are built in three capacities: 12, 20 and 30 gallons per minute. Operating pressures from 50 to 1000 lbs. P.S.I.

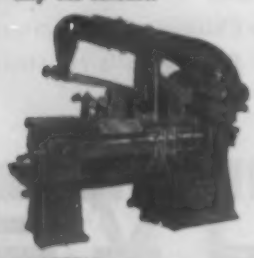
These Pumps have been used for over fifteen years by Machine Tool Builders, Press Manufacturers, Builders of Road Machinery, in the Plastics Field and scores of other industries.

RACINE hydraulic engineers and field men have contributed much, to many highly successful hydraulic installations. Their services are available without cost to you. Write for interesting Catalog P-10-C and with your request outline your hydraulic problem.

Hydraulically Balanced Sleeve Type Valves

RACINE provides a full line of Hydraulic Control Valves. Incorporating sleeve design and with the valve piston surrounded by oil these valves are "easy operating" to insure smooth, sure control of your hydraulic circuits.

Sleeve design provides round ports for gradual tapering of oil flow — shock to entire system that develops through ordinary porting is eliminated. These high quality valves are available in ⅜" to 1½" standard pipe sizes for use in any oil circuit.



The Production Saws of Modern Industry

For your metal cutting work use RACINE Metal Cutting Machines, during almost 40 years "The Standard for Quality and Precision." A full range of sizes 6" x 6" to 20" x 20". Hydraulic feed and control. Hydraulically actuated automatic stock feed for multiple cutting. Write for Catalog No. 12, and at the same time outline your needs. RACINE TOOL AND MACHINE COMPANY, 1759 State Street, Racine, Wisconsin, U. S. A.

RACINE ECONOMIES

Variable Volume Feature
—increases the range of application.

Lower operating costs
—no friction loss through relief valves to cause heating.

Lower initial costs
—because one pump supplies built-in control of volume and pressure.

Less horsepower required
—lower operating and maintenance expense.

RACINE

Racine

HARDESTY DIBUTYL SEBACATE means HIGH SOLVENCY and WIDE COMPATIBILITY

High solvent power and compatibility with a large number of resins and elastomers are the two most important properties required in a really good plasticizer. Hardesty Chemical DIBUTYL SEBACATE possesses both of these desirable properties to an outstanding degree.

Hardesty DIBUTYL SEBACATE is compatible with most of the resins and elastomers used in the plastics and protective coatings industry, and is particularly recommended for use with the following:

VINYL COPOLYMERS
POLYVINYL BUTYRAL
POLYVINYL CHLORIDE
NITROCELLULOSE
CELLULOSE ACETOBUTYRATE
ACRYLIC RESINS
NEOPRENE
THIOKOL TYPE R D
GR-N SYNTHETIC RUBBER

Hardesty Chemical DIBUTYL SEBACATE has high solvent power for most resins and elastomers, and is therefore easily incorporated into the plastic mass with a minimum of milling. Hardesty Chemical DIBUTYL SEBACATE is tasteless and has no residual odor. It is extremely resistant to yellowing on long exposure to light and retains its plasticizing effect at extremely low temperatures.

A letter to HARDESTY CHEMICAL COMPANY will bring a sample and further information by return mail.

HARCHEM

PLASTICIZERS

Alkyl Roleates
Dibutyl Sebacate
Capryl Alcohol

Properties of Dibutyl Sebacate

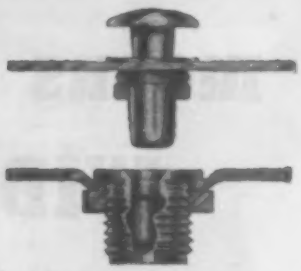
Purity	98.5% minimum
Specific gravity	0.935 20/20°C.
Acidity as Sebacic	0.3% maximum
Color	Light straw
Sediment	None
Ash	0.001% maximum
Copper	None
Iron	0.3 ppm maximum
Butanol	0.1% maximum
Flash Point	380°F.
Fire Point	420°F.
Boiling Point	344°C. at 760 mm. 175–180°C. at 3 mm.
Water Solubility	Less than 1% at 25°C.
Freezing point	11°F.
Weight per gallon	7.8 lbs.
Index of Refraction	1.4391 at 25°C.
Dielectric Constant	3.6
Power Factor—60 cycles	6

HARDESTY CHEMICAL COMPANY, INC., 41 EAST FORTY-SECOND STREET, NEW YORK 17, N.Y.

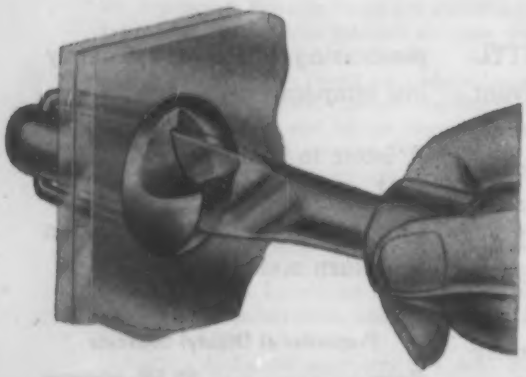
ONE OF THESE NEW fastening

QUICK-LOCK

Only initial loads are carried by helical spring. Increased loads are taken by solid supports, assuring minimum deflection. 90% rotation locks or unlocks fastener. Stud is self-ejecting when unlocked. No special tools required for stud installation.



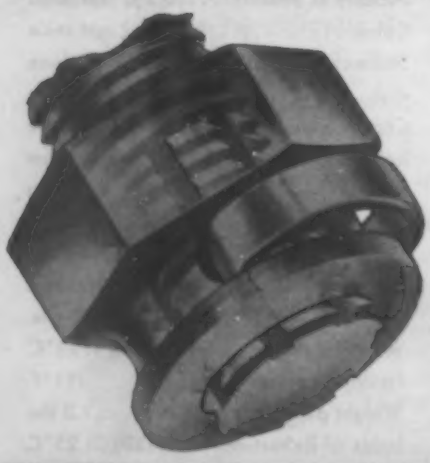
Standard studs can be used with air and water tight receptacle assemblies. Handles large range of material thicknesses by varying depth of receptacle-installation dimple.



SPRING-LOCK

An inexpensive one-piece fastener—simple to install, self-adjusting for various thicknesses. Locks and unlocks with a quarter-turn in a 90° clockwise rotation. Can be permanently installed for use as a blind rivet.

HOW SIMPLE



LOCK NUT

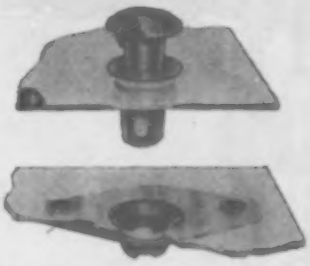
Double Duty Safety Nut—Lock Nut and Stop Nut.

AS A LOCK NUT. One end of safety ring engages nearest serration on bolt thread. With 7 serrations there are 14 locking positions per revolution.

Safety Ring in unlocked position on long thread. Serrations on the bolt threads can be cut by a simple broaching operation on a production basis in a fraction of the time it takes to drill a cotter pin hole.

Write for samples of Simmons Fasteners or call in a Simmons Engineer. He will be glad to help you to adapt any of these principles to your particular application.

methods SOLVES YOUR PROBLEM



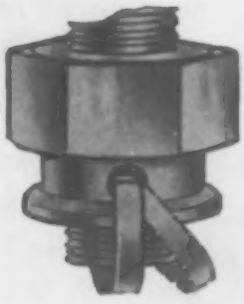
Oval-Head Stud and Plate-Type Receptacle. Plate-type is interchangeable with all standard A-N Receptacles. No special tools required.

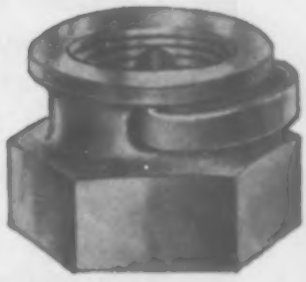
Tapered principle is particularly valuable in assembling curved sheets such as engine cowlings.

Adjustable fastener, using one stud and one adjustable receptacle fastens material thicknesses ranging from 1/32" to 5/16". By reversing flange, increased range 5/16" to 3/4" can be obtained.

IT IS TO INSTALL THE SPRING-LOCK FASTENER

AS A STOP NUT. Can be used without serrated thread, providing close adjustment. When nut is tightened and safety ring snapped in locked position, ends of ring bite into thread, providing stops for nut.





One Safety Nut for all purposes. Assures highest degree of permanence and safety—reduces assembly time.

U. S. AND FOREIGN PATENTS APPLIED FOR

SIMMONS FASTENERS

SIMMONS FASTENER CORPORATION • 1734 NORTH BROADWAY, ALBANY 1, N. Y.

For Plastic Molding Use This Hy-Speed Baldwin Press with Electronic Heating

In one production test, workmen turned out 20% more pieces with an experimental 6-cavity mold than were turned out with a standard 24-cavity compression mold. Mold savings in this instance were estimated at $6000. In addition, the precise extrusion eliminated flash and sprue, and produced a saving of 12½% in plastics material.

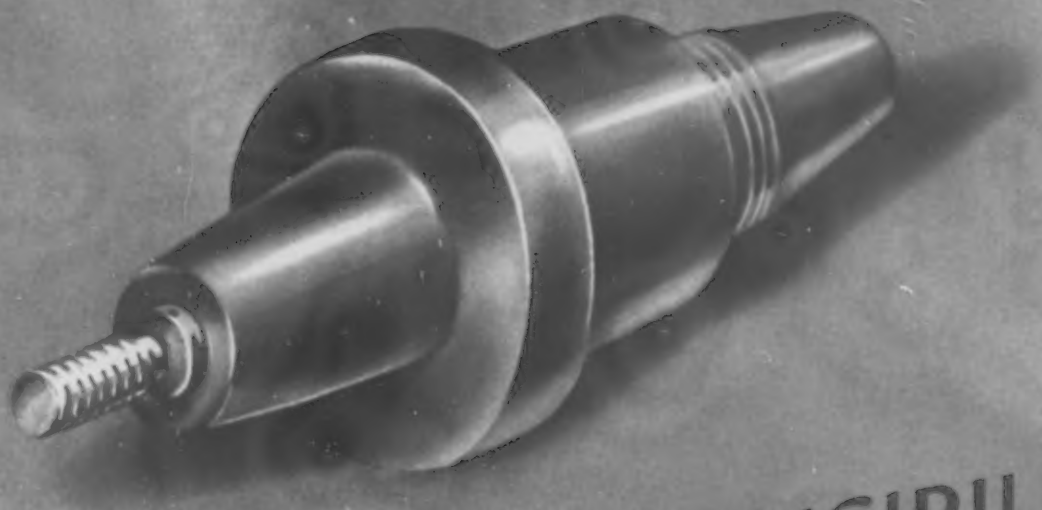
Other savings and advantages revealed by the production performance of the equipment are: (1) reduction of initial investment through use of a smaller press; (2) less wear on molds, permitting use of more easily hobbed materials, and extending mold life; (3) considerable reduction in finishing.

These results are convincing evidence of the possibilities of this new process. Baldwin engineers will be glad to work with you, in developing practical applications to your production needs. If you would like a complete story of the new press, ask for Bulletin No. 221. The Baldwin Locomotive Works, Baldwin Southwark Division, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, St. Louis, San Francisco, Houston, Pittsburgh, Detroit.

BLW THE BALDWIN GROUP

BALDWIN

HYDRAULIC PRESSES



UNDIVIDED RESPONSIBILITY ... is needed for quality

To assume complete responsibility, we design and build all of our dies, make and plate all inserts, finish machine to *any* tolerance and inspect to your specifications.

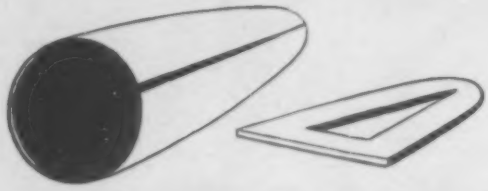
The result: Pieces ready for use without additional labor on your part.

For your tough plastics problems
IN COMPRESSION, INJECTION, TRANSFER MOLDING *and* PRECISION FABRICATION

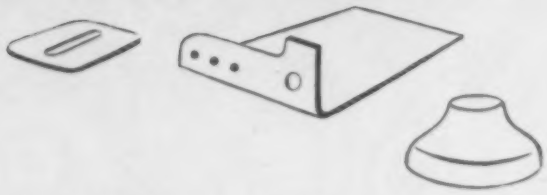
ARNOLD **Brilhart** LTD

435 MIDDLENECK RD. GREAT NECK, N.Y.
Phone: GREAT NECK 4054

PULP AND PAPERS, CUSTOM-MANUFACTURED FOR PLASTICS APPLICATIONS



Impregnating Papers for Industrial Laminates



Precision-Made Resin Impregnating and Coating Base Stocks with **UNIFORM** Density Formation Caliper

Because of Munising's continuous research in pulp and paper manufacture, specifications formerly considered impossible of attainment are now accepted as normal. And, results from producing laminating papers for varying requirements indicate definite advantages in building the paper to fit the individual need.

Munising Papers, Custom-Manufactured for Industrial Laminates, offer these characteristics:

1-CONTROLLED UNIFORMITY...in Density, Caliper, and Fibre Formation..to insure Uniform Absorbency.

2-STRENGTH in aqueous and non-aqueous solvents.

For electrical or mechanical uses, Impregnating Papers can be developed to include definite properties necessary for simplified and uninterrupted production. If yours is a problem of this type, or one where individualized paper might be the solution, may we suggest you contact us?

The Munising Paper Company

Sales and Executive Offices • 135 South La Salle Street, Chicago 3, Illinois • Pulp and Paper Mills at Munising, Michigan

MUNISING PAPER

◆ MANUFACTURERS OF PRECISION MADE PULP AND PAPERS FOR MORE THAN 40 YEARS

IMPACT!

Chemaco Ethyl Cellulose

A tough plastic for tough jobs — Chemaco Ethyl Cellulose meets the strictest tests in vital military and industrial specifications. When operating conditions demand a plastic that can take impact at −40°F. without cracking or chipping, choose Chemaco Ethyl Cellulose. When you need a plastic that is virtually shatter-proof . . . a plastic that will stand up under real abuse . . . Chemaco Ethyl Cellulose is the answer.

For everything from tool handles to battery housings, the easy moldability of Chemaco Ethyl Cellulose furnishes clean, strong sections that provide long lasting service. It is available in colors and translucents—in a wide range of flows to meet your most exacting requirements. Consult Chemaco engineers when you are choosing a material for a special job. They are always glad to offer help in determining the best plastic and the exact formula. Chemaco makes four thermoplastics—Chemaco Cellulose Acetate, Ethyl Cellulose, Polystyrene and both rigid and elastomeric Vinyl Compounds.

Send for the new Chemaco booklet on plastics. Write Chemaco Corporation, 120 Snyder Ave., Berkeley Heights, N. J.

Chemaco Corporation

A subsidiary of Manufacturers Chemical Corporation

Berkeley Heights, N. J.

Branch Office—Cleveland, O. Representatives—Los Angeles • San Francisco

WHY TRANSFER MOLDING PERMITS BETTER HOLES

Molding thermosetting plastic materials with deep holes, small holes, or side holes becomes easy when the patented transfer molding process is employed.

In transfer molding, the mold is closed and then the compound is subjected to heat and pressure in a connecting chamber, from which it flows into the mold for curing.

This means that the long, slender core pins required are not distorted. Since the mold is closed before entrance of the compound, the pins will be fully supported at both ends before being stressed by the moving plastic.

The advantage of transfer molding in making pieces with side holes, as shown at right, comes from the fact that side core pins are not subjected to the high local stresses often encountered during compression molding.

Transfer molding uses conventional compression-type presses. Wartime production demands have proved its numerous advantages over and over again. For production economy, in-use strength and saleable beauty, plan on transfer molding for meeting peacetime demands.

SHAW

SHAW INSULATOR COMPANY

160 COIT STREET IRVINGTON 11, N. J.

QUALITY MARK ON MOLDED PLASTICS

LITERATURE IS AVAILABLE AS FOLLOWS:

A list of nearby licensees who can offer you the advantages of this patented process.

Two bulletins on "Why Transfer Molding is Economical". A bulletin on "Why Transfer Molding Gives Fine Inserts" and one on "Why Transfer Molding Improves Appearance". Reprints of technical articles by Shaw engineers.

Between Shaw and the Plax Corporation, Hartford 5, Conn., a broad range of plastic materials and processes is covered. Both offer unbiased help in plastics applications. For the names of licensed transfer molders or for the literature listed above . . . write Shaw.

NEW SPECIAL PLASTIC SHAPES BY PLAX

Molding and continuous extruding by Plax, of special shapes in hitherto impossible sizes, open up a whole new realm of plastics applications.

While these applications have been restricted to wartime necessities, and for the most part may not be revealed, the mere indication of the shapes and sizes themselves will excite engineering minds to the visualization of their full possibilities.

The pieces shown in the photograph at the left range from a two-inch-thick slab of polystyrene to a six-inch-diameter cylinder and a four-and-one-half-inch diameter tubing with three-eighths-inch walls. These, the fluted tubing, the piece with varying cross-section, and many other special shapes can be produced in all colors, from crystal clear through jet black, in polystyrene and other thermoplastic materials.

Subsequent machining, with which Plax is thoroughly familiar, can produce unusual structural combinations with superior insulating and other desirable characteristics common to polystyrene and other plastics.

LITERATURE IS AVAILABLE AS FOLLOWS:

Several bulletins on Plax polystyrene products and how to machine them.

A technical article on Plax blown products.

Bulletins on Plax cellulose acetate, cellulose acetate butyrate, methacrylate, and polyethylene products.

Styramic and ethyl cellulose are among the other materials offered by Plax in various forms. In cooperation with the Shaw Insulator Company, Irvington 11, N. J., Plax can give you help covering nearly all plastic materials and methods. For such help, or for any of the literature listed above . . . write Plax.

PLAX
FOR PLASTICS
NOT SUBSTITUTES···IMPROVEMENTS

133 WALNUT STREET ★ HARTFORD 5, CONNECTICUT

PLASTICS INFORMATION

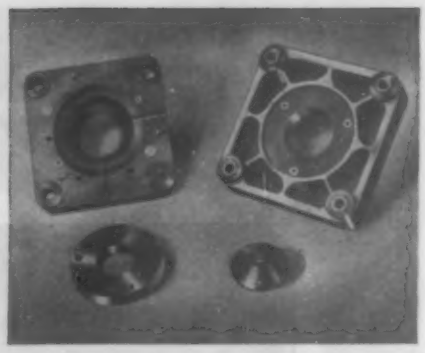
YOURS...IN THIS CONVENIENT FILE FOLDER

Our handy-reference Folder is designed to be a useful part of your plastics source file. It contains information on the facilities of our organization for plastics engineering, designing, molding and assembly, and includes examples of plastics applications that may have a relationship to your peacetime products. The Folder is free, on request.

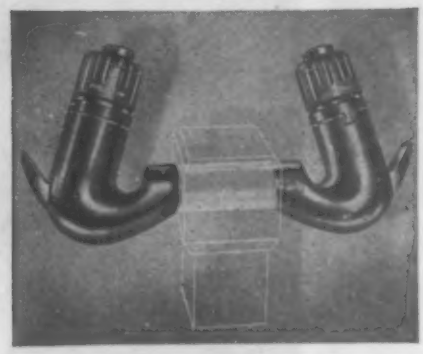
Plastics should be reappraised now in the light of improved methods and materials that have been tested in extensive wartime applications. To help you in your consideration of plastics, send for our Folder File. And call on us early in the design stage of your products. This assures the fullest benefit from our molding experience, and the most practical advantages from plastics.

PM
REG. U.S. PAT. OFF.

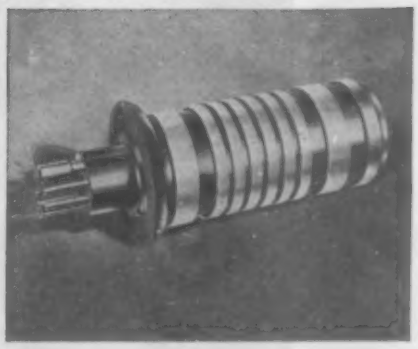
Write now for Folder File MP7



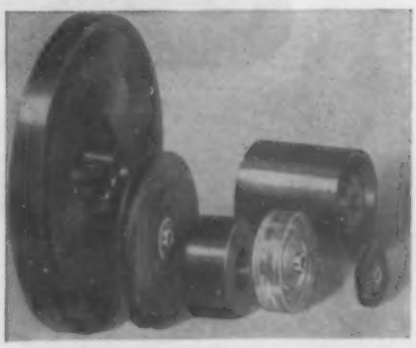
PRECISION MOLDED PARTS



PLASTIC CONTROL GRIPS



PLASTICS AND METALS COMBINED



PLASTIC WHEELS for Many Uses

PLASTIC MANUFACTURERS

INCORPORATED

STAMFORD, CONNECTICUT

MOLD MAKING • INJECTION & TRANSFER MOLDING • COMPLETE ASSEMBLY

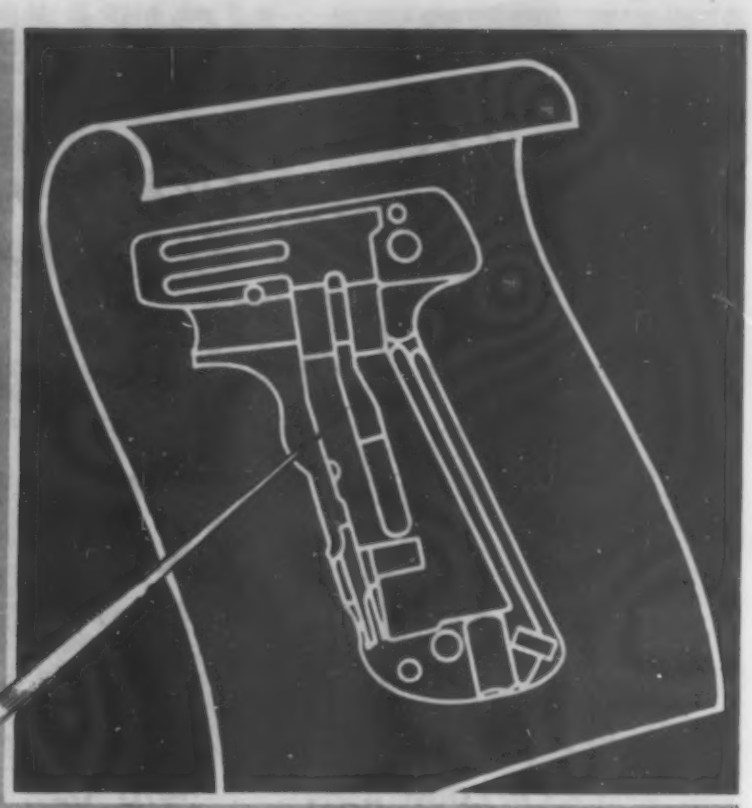
Representatives: DETROIT 2—805-06 New Center Bldg. • LOS ANGELES 35—1440 So. Robertson Blvd.

CANADA—A. & M. Accessories Ltd., 19 Melinda Street, Toronto; 1405 Bishop Street, Montreal

Deering Milliken
TEXTILES
FOR THE
PLASTICS
INDUSTRY
Let our Technicians help you with your post-war planning
DEERING MILLIKEN & CO.
INCORPORATED
240 CHURCH STREET, NEW YORK 13, N. Y.
Sales Offices:
CHICAGO . . . . . 300 West Adams Street
DALLAS . . . . . 503 Texas Bank Building
LOS ANGELES . . . . . 111 West Seventh Street

BLUEPRINT YOUR POST-WAR PLASTICS

Design of a molded part is the first consideration of Watertown engineers. This includes consideration of dimensions, form and ultimate use and involves choice of material as well.



The preliminary steps to intelligent planning are part of Watertown's complete service. They include:

- ★ Consultation on design and function of part
- ★ Choice of material and tailoring of materials to meet requirements
- ★ Building of model and construction of sample mold cavity
- ★ Testing of sample molding to insure performance in actual use
- ★ Construction of multiple cavity mold based on experience obtained from sample.
- ★ Molding by compression, injection or transfer press.
- ★ Testing, finishing and assembling

For over 30 years Watertown has offered a complete custom service. If you are planning to use plastics, check with our engineers. The Watertown Manufacturing Company, 1000 Echo Lake Road, Watertown Connecticut. Branch office—Cleveland. Sales offices in Chicago, Detroit, Milwaukee, New York and Hawaii.

Send for the new Watertown Book of Plastics.

Write to Department D, The Watertown Manufacturing Company.

Watertown

A NAME AS OLD AS THE PLASTICS INDUSTRY

SAFE DEPOSIT BOXES FROM THE PX . . .

clue to better packaging for tools or textiles . . . candy or cosmetics

For countless postwar packages, the cellulosics promise a new high in saleability and economy. Outstanding war-time examples are these soap and toothbrush boxes, molded by Boonton Molding Co. from cellulose acetate for Lester D. Lawson. Demands in 1943–1944 alone exceeded 4,000,000! Why? Largely because GI's and bluejackets found them sturdy enough to serve many other needs . . . as shaving mugs, receptacles for valuables, even as mailing containers!

If *you* seek increased sales with dual-use packages or extra eye-appeal, the cellulosics offer unequalled toughness, luster, light weight, unlimited color range—plus the savings of high-speed injection molding and production-line packaging.

Toughness and grease resistance for tool packages

Transparent protection for shirts or sheets

Light weight and lustrous color for cosmetic containers

HERCULES

CELLULOSE ACETATE
CELLULOSE NITRATE
ETHYL CELLULOSE

For general-purpose production plastics

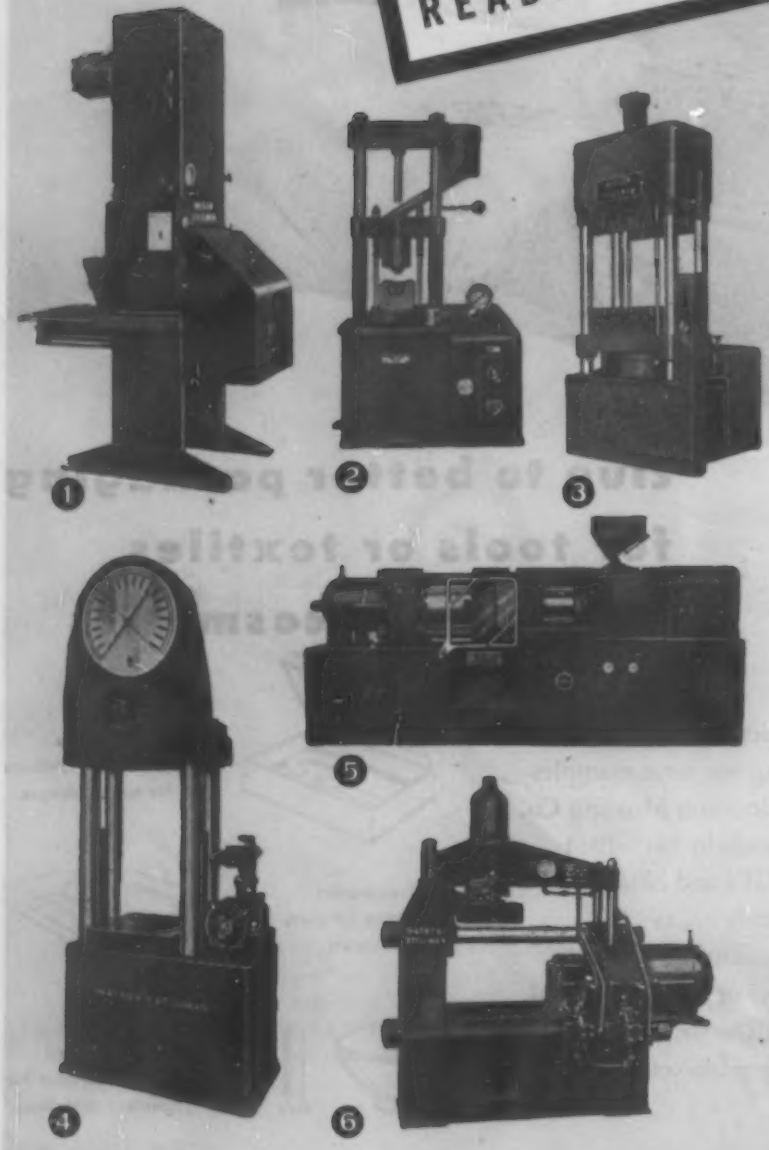
Hercules does not make plastics or molding powder, but supplies the high-quality cellulose derivatives from which they are made. For data, please write

HERCULES POWDER COMPANY INCORPORATED 916 Market Street, Wilmington 99, Delaware.

CP-67

Complete line of STANDARD MOLDING PRESSES

READY FOR WORK



1. Full Automatic Compression Molding Press
2. 1 Ounce Injection Molding Press
3. Compression Transfer Molding Press
4. Laboratory Press
5. Horizontal Injection Molding Press
6. Angle Molding Press

The ever increasing variety of plastic materials, along with the need for intricate molded parts, requires versatility in molding methods and molding machines.

Making a complete line of standard molding presses is one job. Assisting in the scientific selection of a molding press *suited to the job* — is another. Watson-Stillman does both. If your problem is getting more production fast — do as other molders do — rely on W-S years of experience in solving molding problems and write today for advice. Our engineers can best serve you if they fully understand your molding problem, so make your inquiry complete as possible.

WATSON-STILLMAN

FACTORY AND MAIN OFFICE
ROSELLE, NEW JERSEY

BRANCH OFFICES

WASHINGTON, D. C.
PHILADELPHIA, PA.
NEW HAVEN, CONN.
CHICAGO, ILL.

REPRESENTATIVES

WASHINGTON, D. C. . . . . Ralph Payne (R. R. Equip.)
INDIANAPOLIS, IND. . . W. K. Millholland Machinery Co.
CHICAGO, ILL. . . . . E. L. Essley Machinery Co.
MILWAUKEE, WISC. . . . . E. L. Essley Machinery Co.
ST. PAUL, MINN. . . . . Anderson Machine Tool Co.
SAN FRANCISCO, CAL. . . . . Jenison Machinery Co.
PITTSBURGH, PA. . . . . Laird and Johnson
CLEVELAND, OHIO . . The Cleveland Duplex Machinery Co.
DETROIT, MICH. . . . . Peninsular Machinery Co.
GRAND RAPIDS, MICH. . . . . E. L. Essley Machinery Co.
LOS ANGELES, CAL. . . . . Smith Booth Usher Co.
SEATTLE, WASH. . . . . Star Machinery Co.

CANADA: Canadian Fairbanks-Morse Co., Ltd. • Branches in All Principal Cities

WILLIAM A. CROWDER . . . Graduate Chemical Engineer. Pioneered first commercial hard chromium plating plant in U. S. Twenty years' identification with research, development and practice of hard chromium plating. Inventor of several processes for electrolitic deposition of iron and iron-nickel alloys. Originator, designer and patentee of hard chromium techniques, equipment and plants. Founder and managing owner of Industrial Hard Chromium Co. President of Industrial Hard Chromium Plating Equipment Corporation, manufacturers of technically developed plating equipment.

INDUSTRIAL HARD CHROMIUM CO.

announces the formation of a

Research and Development Division

to assist the

Plastics, Rubber and Synthetic Industries

To this new division, William A. Crowder will contribute the problem-solving advantages of his hard-chromium plating knowledge and experience.

L. E. Welch, acting as liaison engineer between *plastics* and *plating*, will, through his plastics know-how, advance the value of the division's service-wise helpfulness.

Your mold-making problems are as welcome to this new department as their solution will be to your plastics production!

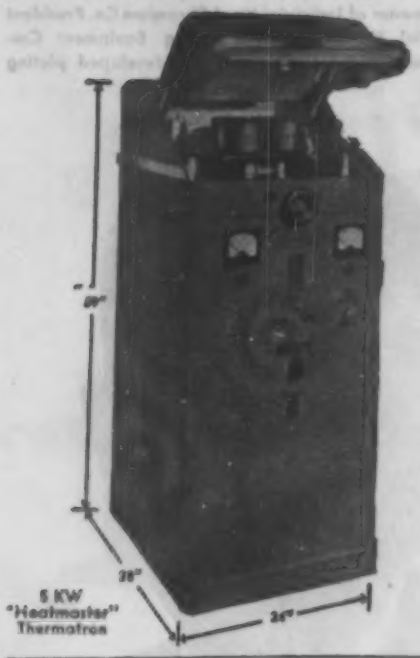
L. E. WELCH . . . Graduate Mechnical Engineer. Several years' experience as Materials and Design Engineer with General Electric Co. Four years with Bakelite Corporation, devoted to researching and designing of molds and mold equipment. Author of several technical papers bearing upon materials and stress-analysis. Engineered the development of the Frangible Plastic Bullet — designed the basic tools for its production. Experienced in the fundamentals and application of hard-chromium plating to molds and equipment for molding and fabricating plastic materials.

INDUSTRIAL HARD CHROMIUM CO.

"Armorplate for Industry"

15 ROME STREET, NEWARK 5, N. J.

RADIO RECEPTOR'S NEW "MASTER" SERIES THERMATRON ATTRACTING WIDE ATTENTION



The new "Master" Series of THERMATRON electronic dielectric heat generators, headed by the popular 5 Kilowatt output "Heatmaster," is now enlarged by the addition of two new models. They are the "Heatmaster, Jr.", with an output of 2½ Kilowatts, and the "Weldmaster" and "Weldmaster, Jr.", especially designed for sealing and bonding thermoplastic sheets, with outputs of 1 Kilowatt and 500 Watts respectively. According to *Radio Receptor* engineers, each of these machines fills a definite place in the new industry which is growing up around electronic heating.

The "Heatmaster" illustrated gives a new high value per dollar in electronic heating, and has the additional advantage of occupying little floor space. As shown, it incorporates a built-in, highly shielded "oven," or electrode cage, automatically operated, and designed especially for the plastic and rubber industry. It is also supplied without the "oven" so that it may be used with external electrodes in connection with conveyor belts or other applications. Floor space is only 24" x 48".

The "Heatmaster, Jr." embodies the same excellence in design, manufacture and the use of highest class standard components including the new type radial fin tubes as the "Heatmaster," but has an output of 2½ Kilowatts or a BTU output of 8550 per hour as against the 17,000 BTU's of the larger model. The same safety features and simplicity of control as characterize the larger model are found in the "Heatmaster, Jr." Both models are available at 27.4 mc frequency, and at 15 and 5 mc as may be required. Other frequencies can be supplied. The larger model operates on 200 volt 60 cycle three-phase current, while the smaller unit runs on 200 volt 60 cycle single-phase.

A folder describing the complete THERMATRON line will be forwarded on request.

"Desalter" Life Saver Produced on THERMATRON Machines

The Permutit Company's "desalter," which makes sea water potable in 20 minutes and which has been supplied by the hundreds of thousands to Army and Navy fliers who may be possibly forced down at sea, is known to many. It is one of the outstanding developments of the war. But what is not generally known is that the Gemloid Corporation of Elmhurst, Long Island, which makes a large proportion of these "desalters," uses THERMATRON in their assembly. THERMATRONS of the "Weldmaster" series are designed especially to weld, seal or bond thermoplastics such as Vinylite, of which these bags are made. Both the "Weldmaster" of 1 KW output and the "Weldmaster, Jr.", which has an output of 500 watts, are designed for welding or bonding thermoplastics. The Permutit "desalter" is a tough, collapsible, non-corrodible plastic bag with a simple strap closure and built-in filter that can be used over and over again. This product is the forerunner of many other plastic products to be manufactured economically on THERMATRON electronic heat welders by Gemloid and other plastics products makers.

Already, manufacturers of such products as raincoats, shower curtains, baby pants, tobacco pouches, cosmetic bags and other articles of widespread use, are displaying great interest in this new production method which offers so many outstanding advantages.

Radio Receptor Company's laboratories offer manufacturers a complete service in the adaptation of electronic dielectric heating equipment in their manufacturing processes. While the plastic industry has been among the first to grasp the possibilities of this new tool, many other industries are searching out its potentialities and are making plans to use THERMATRONS as soon as they become more generally available.

Permutit Desalting Bag

RADIO RECEPTOR COMPANY, Inc.
251 WEST 19th STREET NEW YORK 11, N.Y.
Engineers and Manufacturers of Airway and Airport Radio Equipment
SINCE 1922 IN RADIO AND ELECTRONICS

UNIVERSAL

PLASTICS CORPORATION

NEW BRUNSWICK
NEW JERSEY

Main Office: 270 Madison Avenue, New York 16, New York; Steel Mill Products Company, Inc.: 176 West Adams Street, Chicago 3, Illinois; Paragon Sales Company, Inc.: 111 South Street, Philadelphia, Pennsylvania; June & Company: 719 New Center Building, Detroit 1, Michigan.

Custom Molders

AT THE RISK OF REPEATING OURSELVES . . . . . .

We have reprinted "A Ready Reference to Plastics," our little book which is an introduction to the industry, in several editions to take care of the influx of inquiries. A copy of the current edition is available without charge to business men and Government employees.

We have been saying certain things over and over again in a slightly different way each time (we hope) for a number of years. Because we have always talked about the fundamentals of our business—why we started it—what it's for—how we run it and what all this can possibly mean to you.

Behind this talk there is some pretty solid stuff. We have a pretty nice molding plant—one of the nicest for its size in the business. It is clean, neat, and we think efficient.

We started our business because it seemed like a good way to make money while we were doing something that we liked. When we started out, plastics did not have the glamor or the publicity they now get. If you went into this business, it was because you felt that it had a future. We hoped so then, now we are sure, after having sort of grown up with the industry during the last quarter century.

Of course we have molded a lot of different kinds of things—some of them with consumer appeal (before the war) some of them for industry and some for direct war use. We are, of course, concentrating on the last two right now, but the day is probably not far off when we will be able to serve consumer requirements again. Bear us in mind.

BMCO

ARMY E NAVY

BOONTON MOLDING COMPANY

MOLDERS OF PLASTICS · PHENOLICS · UREAS · THERMO PLASTICS

BOONTON · NEW JERSEY · Tel. Boonton 8-2020

NEW YORK OFFICE

Chanin Bldg., 122 East 42nd Street, New York 17, N. Y., MUrray Hill 6-8540

FROM EVERY ANGLE...

WALKER-TURNER DRILL HEADS SIMPLIFY RETOOLING PROBLEMS

Four Radial Drill Heads mounted horizontally are used by S.K.F. Industries to drill two opposed holes in bearing races. The drill spindles are interconnected and operated simultaneously, completing two bushings in one operation.

Two Radial Drill Heads working in conjunction to rough grind lens blanks to specified curvature.

20" Drill Head converted to a highly efficient Jig Drill does the work of a 12 foot Radial.

Check These High Spots:

- Operate vertically, horizontally, at any angle — even upside down.
- Careful selection of materials, superior design, rugged construction, assure long service at high level of precision.
- Speed ranges from 85 to 8300 R.P.M.
- Safe, simplified operation.
- Low initial cost—low power consumption—low maintenance.
- Handle Metals, Plastics, Wood, Ceramics, Glass.

For a faster reconversion when the time arrives, it will pay you to look into the tooling possibilities of Walker-Turner Drill Heads, *now!*

Compact, flexible Walker-Turner Drill Heads are available in 20" models (hand or power feed) and 15" models (hand feed or radial). Four ball bearings on splined spindles—full floating spindle pulley — one-piece head casting—many other features—maintain high production and precision, while slashing costs!

WRITE TODAY FOR FREE, FACTUAL DRILL HEAD FOLDER — shows typical special tooling set-ups — construction details — cutaway drawings — prices.

WALKER-TURNER CO., INC., PLAINFIELD, N. J.

walker-Turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

HYCON

REGISTERED TRADE MARK

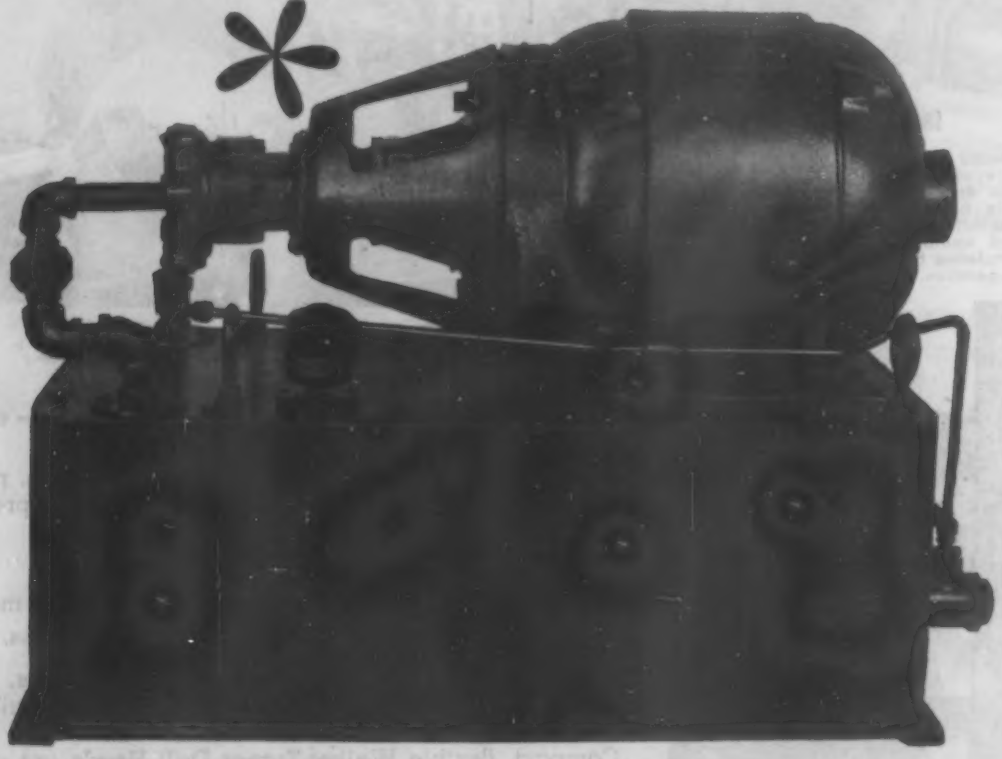
The wide field of use is illustrated by the list of applications shown below where these compact units have displaced manual and mechanical equipment.

TEXTILE FINISHING ROLLS • STEEL ROLL MILLS
BRASS ROLL MILLS • SCALE BREAKER ROLLS
STARTING TORQUE RELIEF • DIE CLAMPS
PRODUCTION PRESSES • LABORATORY
PRESSES • HYDROSTATIC TESTS • AUTO-
CLAVE PRESSURE SEALS • BEARING
FLOTATION • HIGH PRESSURE CLOSING
AND DWELL

Automatic
Hydraulic Pressure

•

1.2 GPM	3000 p.s.i. Continuous	33″x 15″x 13″ High
2.4 GPM	3000 p.s.i. Continuous	33″x 16″x 24″ High



To provide for a wider range of automatic control, the basic units can be furnished with accessory equipment including accumulators, pressure switches, pressure metering valves, manual or solenoid operating valves.

For operations requiring large prefill capacities, comparable units are built with two-pump combinations to provide high volume, low pressure, and high pressure closing and dwell cycles.

Write today for detailed information

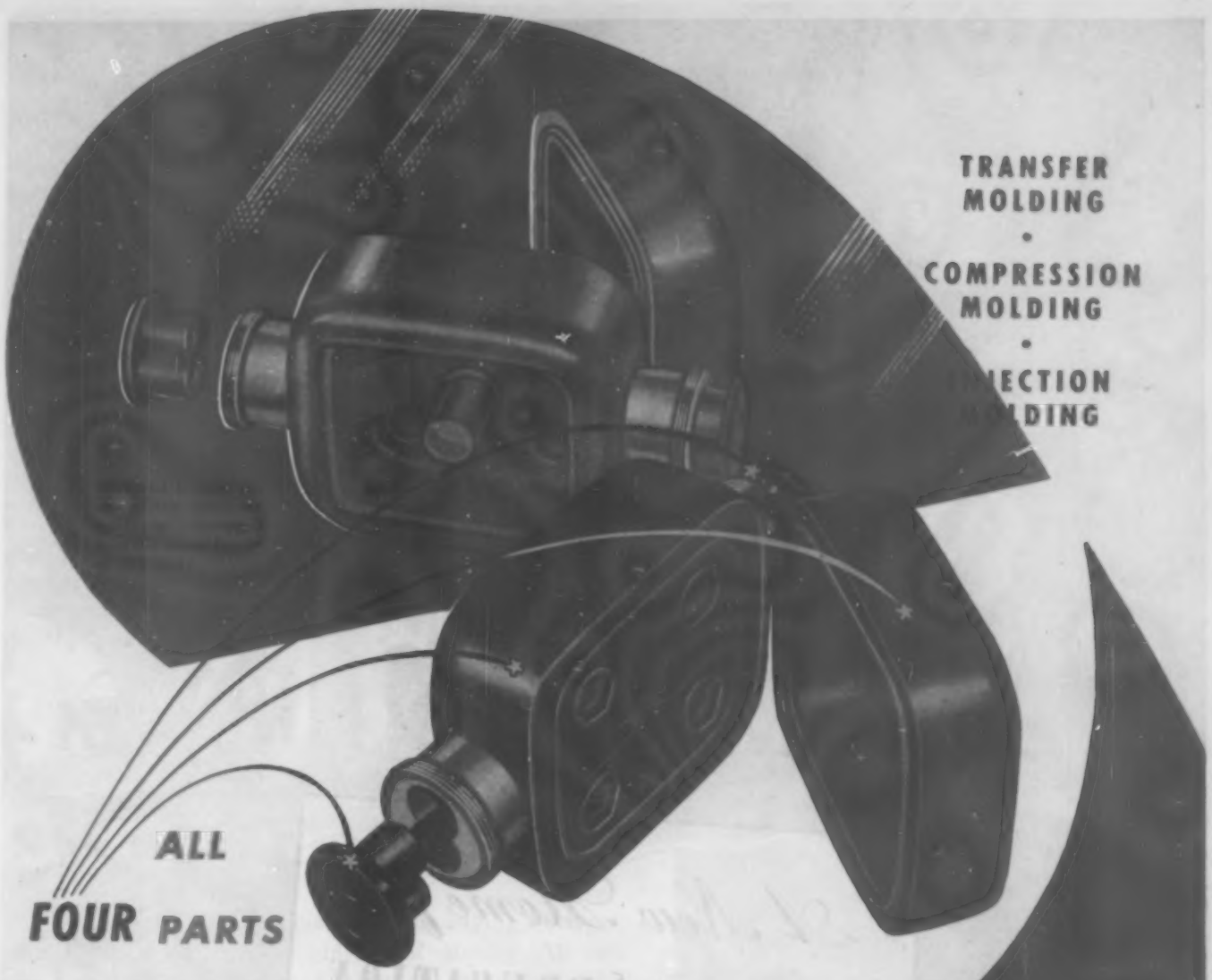
EXPERIENCED HYDRAULIC ENGINEERING SERVICE IS AVAILABLE

•

THE NEW YORK AIR BRAKE COMPANY

Hydraulic Division

420 LEXINGTON AVENUE, NEW YORK 17, N. Y. FACTORIES: WATERTOWN, N. Y.



TRANSFER MOLDING
•
COMPRESSION MOLDING
•
[illegible]ECTION [illegible]LDING

ALL
FOUR PARTS
TRANSFER MOLDED IN ONE OPERATION

This electrical "foursome" comprises an intricately designed body with two threaded aluminum tube inserts, a deep heavy-walled cover, a pair of compressors. To process all four in one operation required transfer molding, and a four-cavity die construction of semi-automatic type with one runner. Due to the bulk of the heavy rag-filled high impact matericl, the desired results called for an 18,000 lb. pressure per sq. in. and a goodly share of Consolidated's plastic-know-how!

We are also "at home" to problems calling for Compression and Injection Molding. Experience includes the handling of *all* plastic materials — and the choice of the *right* plastic. Inquiries invited from manufacturers and postwar planners.

"YOUR BLUEPRINT IN PLASTIC"

Consolidated

MOLDED PRODUCTS *Corporation*
309 CHERRY STREET, SCRANTON 2, PA.

Branches NEW YORK • CHICAGO • DETROIT • BRIDGEPORT • CLEVELAND

A New Home for PLASTICS EDUCATION

Now even finer educational facilities are available to those who seek thorough, practical plastics instruction. Plastics Industries Technical Institute has moved its Los Angeles resident engineering school to new and larger quarters on a five-acre campus. The Administration Building is shown in the picture above.

The resident school will continue to provide practical training in its shops and laboratories with equipment similar to that used by the plastics industry. You are cordially invited to visit the new campus when in Los Angeles. Meanwhile, we welcome your inquiries regarding resident plastics training and the home study course.

Plastics
INDUSTRIES TECHNICAL
INSTITUTE

Francis A. Gudger, President · John Delmonte, Technical Director

WRITE DEPT. MPS-6

122 EAST 42ND ST., NEW YORK 17, N.Y. * 221 NORTH LA SALLE ST., CHICAGO 1, ILL. * 1601 SOUTH WESTERN AVE., LOS ANGELES 6, CALIF.

THE "PORCUPINE" HAS QUILLS OF GRAPH-MO STEEL

In order to speed production of the Flying Fortress, inventive Tooling Engineers of Boeing Aircraft Company designed and built the "porcupine", a tool that punches out 388 exactly placed rivet holes with a single stroke of a mammoth press. In five fast operations this ingenious tool punches the 976 holes needed to rivet together all the parts of a Fortress bomb-bay catwalk—*thirty times quicker* than the former method of electric drilling.

Because the "porcupine" was a complex and expensive tool to build, Boeing engineers were very discriminating in their choice of tool steel. That's why they made all the punches and inserts of Graph-Mo Steel.

Graph-Mo an oil hardening steel is one of the five performance-proven Timken Graphitic Steels. Manufacturers report Graph-Mo machines 25% to 30% faster than competing steels. It has excellent non-seizing qualities, offers stubborn resistance to wear and abrasion and shows remarkably good response to heat treatment.

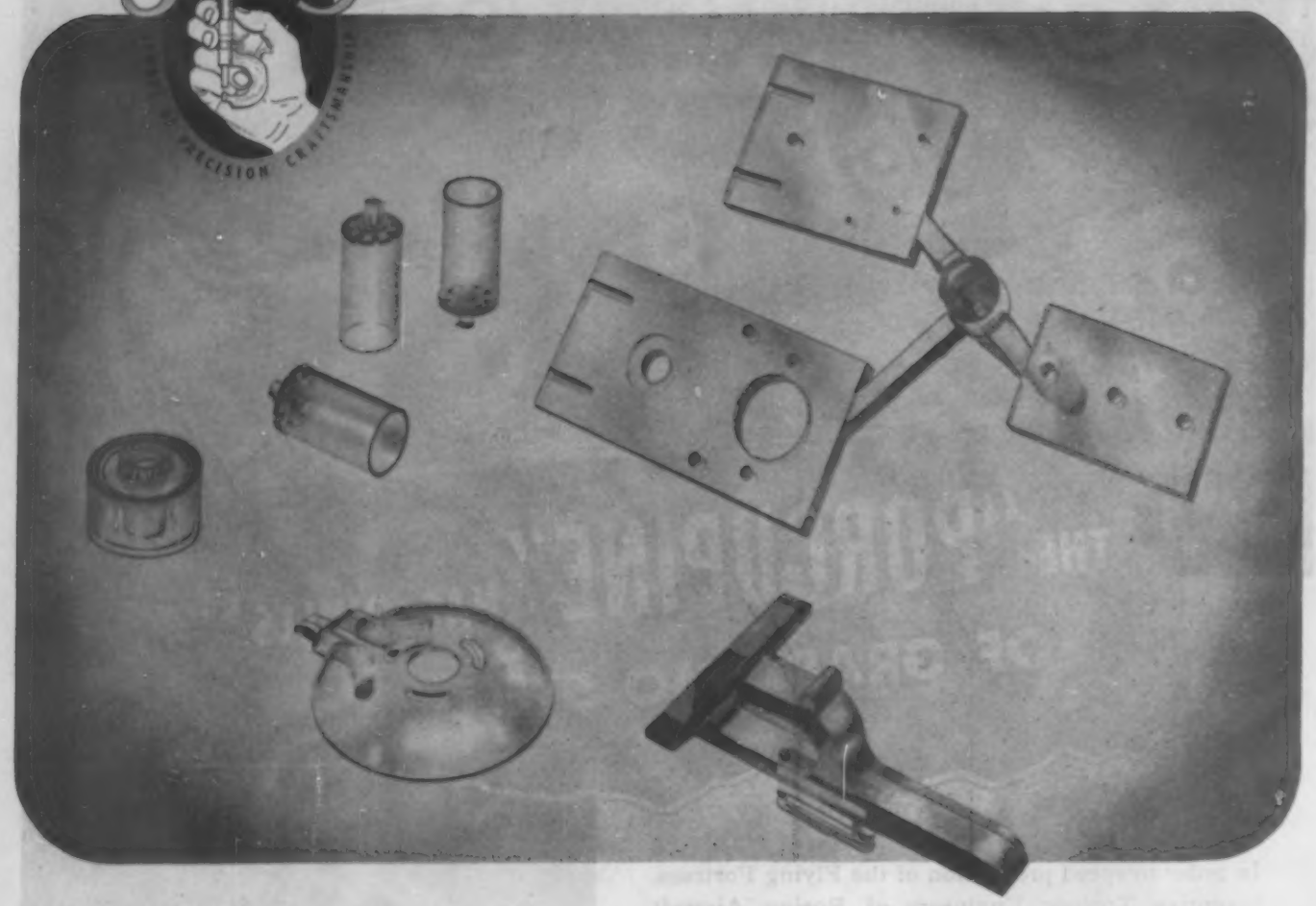
Boeing used every one of these qualities to advantage in producing the "porcupine". You will find them useful to increase the quality and to speed the production of your products. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

A request written on your firm's letterhead will bring a 48 page booklet that is full of useful information about the five Timken Graphitic Steels.

TIMKEN
GRAPHITIC STEELS

Santay

PRECISION CRAFTSMANSHIP



Wherever junctions occur between two or more flowing masses of material, weld lines are inevitable. It's the *unseen, unbreakable* weld lines that characterize fine thermoplastic products by SANTAY. These indistinguishable weld lines result from the surpassing skill and experience of Santay engineers and tool makers. Proper venting, mold heat control, regulated flow of material to cavities to prevent set up of turbulence . . these things, too, contribute toward avoiding the formation of weld lines and give you the ultimate in mold construction. If a better thermoplastic part or product forms a part of your post-war plans, surely Santay Precision Craftsmanship merits first consideration.

Weld LINES

INJECTION MOLDING • METAL STAMPING • ELECTRO-MECHANICAL ASSEMBLIES

SANTAY CORPORATION 355 NORTH CRAWFORD AVE. CHICAGO 24, ILLINOIS

REPRESENTATIVES: POTTER & DUGAN, INC., 29 WILKESON STREET, BUFFALO 2, NEW YORK • PAUL SEILER, 7770 CORTLAND AVENUE, DETROIT 4, MICHIGAN • QUEISSER BROS., 108 E. NINTH STREET, INDIANAPOLIS 2, INDIANA

HOW "Resin Engineering" can SOLVE YOUR Production Problems

Interlake has developed production-stabilized resins for specific applications in coating, impregnating and bonding of . . .

WOOD · PAPER · METAL

GLASS · FIBRE · RUBBER

CELLULOSE

If You Have A Resin Problem . . .

draw freely upon the wide experience of Interlake. We will gladly work with you on any resin problem, or discuss with you the possible advantage of using resins in any operation or process. Write Interlake Chemical Corporation, Plastics Division, Dept. 16, Union Commerce Bldg., Cleveland 14, Ohio.

INTERLAKE Chemical Corporation's "controlled production" starts at Interlake's own coke ovens, where basic raw materials of resins are extracted from coal.

The chemical engineering knowledge and skill that produce Interlake's high quality phenol, ortho cresol, metapara cresol, etc., are equally valuable in the synthesizing of finished resins—in the development of resins with precisely the desired properties for a given job, and —in stabilization of resins for continuous uniformity in performance.

Interlake *functionally engineers* each resin to the user's specific requirements—working in close cooperation with his production men to test and perfect that resin in actual application under normal conditions of use.

That's why important industrial users come to Interlake when contemplating new resin applications—or—when a presently used resin is *not* meeting the functional and production requirements of a particular job with maximum efficiency.

INTERLAKE CHEMICAL Corporation

PLASTICS DIVISION

Specificity IN RESINS

Bazookas are not new in plastic molding!

True, the concussion and deadly intent are lacking. And the aftermath is constructive rather than destructive. But the compelling forcefulness of the principle in lowering sales resistance bears a striking similarity.

Plastic moldings, to "move" at point-of-sale, require commercial bazookas—eye attraction, sleek finish, functional design, rugged construction, etc. Each in its own way, is a prerequisite in tearing down sales resistance, competition and costs.

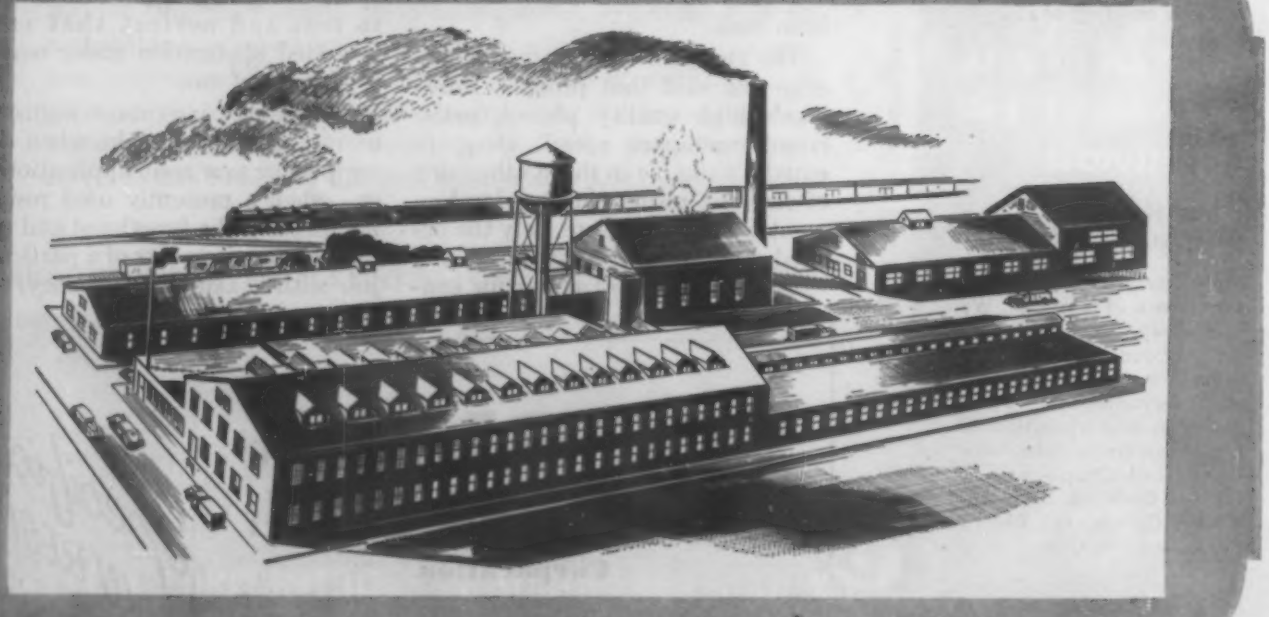
Skill is the ammunition—a quarter century of molding for all phases of industry; facilities are the weapon—three plants for efficiently meeting requirements . . . Wayne, New Jersey; Arlington, Vermont; Waterloo, P. Q., Canada. The bull's eye is the result of close collaboration between all our engineers and technicians.

This versatile "bazooka" can be aimed at your post-war target by addressing inquiries to Mack Molding Company, Inc., 120 Main Street, Wayne, New Jersey.

Mack MOLDED EXCELLENCE

Here is the "home" plant of MACK MOLDING—located conveniently in the New York Metropolitan area. Another completely equipped plant which will be ready for your plastic molding plannings when the war ends.

SALES OFFICES: NEW YORK CITY, INDIANAPOLIS, CHICAGO, DETROIT, BOSTON & ST. LOUIS



Practically all of the standard types of equipment that have been adapted to the manufacture of plastics are equipped with Timken Tapered Roller Bearings and—have been for many years.

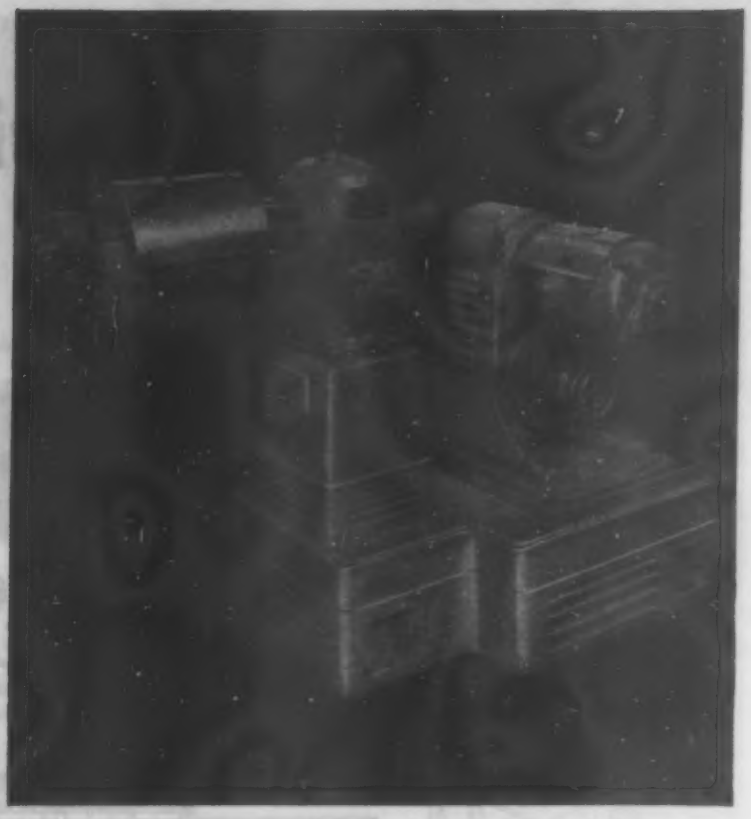
More and more attention is being given to the application of Timken Roller Bearings to machines designed especially for the production of plastics.

One of the most important points for the application of Timken Roller Bearings is on the roll necks of plastics rolling mills. Another is in mixers, where accuracy and endurance are essential. By eliminating friction; preventing wear; carrying radial, thrust and combined loads and assuring correct and constant alignment, Timken Bearings save power, simplify lubrication, cut maintenance cost and prolong equipment life.

Make sure you have Timken Bearings at every suitable position in the plastics equipment you manufacture or buy. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

Designed For Experimental and Product Extruding



Royle No. 1

Royle No. ½

● Rugged is the word to describe these compact and highly efficient Royle Continuous Extruding Machines—the No. ½ and No. 1. Their diminutive size embraces all of the characteristics required for larger and heavier extruding processes.

● Primarily designed to become an integral part of laboratory equipment—the technician can be sure that his experiments will have true relation to actual product extruding—these machines are economical and efficient producers of such products as tubes, rods, fine wire insulation, mono-filament and thread coating.

● Except for dimensional differences these machines possess identical characteristics.

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

James Day (Machinery) Ltd.
London, England
REgent 2430

Home Office
R. H. Davis J. W. VanRiper
Silverwood 2-8262

Akron, Ohio
J. C. Clinefelter
UNiversity 3726

PATERSON 3, NEW JERSEY

WANT 50,000 TWINS...ALL ALIKE?

● Right now, identical twins of molded plastics are rolling off our machines by the thousands, all earmarked for the military services, where uniformity is of prime importance.

In the postwar tomorrow, General Industries will once again be able to offer you the experience and equipment that will mold your plastic parts, efficiently and economically, the last piece as accurate as the first.

From blueprint to finished product, manufacture will be speeded by experienced engineers. For instance, we can offer slight changes in design that will improve the moldability of the product. Ingenious mold makers realize the utmost importance of accurately-placed inserts, close tolerances and finish to meet the most critical specifications. Skillful operators, working with modern equipment, will turn out any quantity of identical pieces that will work smoothly and efficiently in your finished products.

General Industries is among the top capacity molders of America. Our combination of skilled experience, fine craftsmanship and adequate machinery can help mold salability into your postwar products.

THE GENERAL INDUSTRIES COMPANY

Molded Plastics Division • Elyria, Ohio

Chicago: Phone Central 8431 — Milwaukee: Phone Daly 6818

Detroit: Phone Madison 2140 — Philadelphia: Phone Camden 2215

THE GENERAL INDUSTRIES COMPANY

MOLDED PLASTICS

ARMY E NAVY

LESS WEIGHT PER PLANE

...when MICARTA replaces bronze

Micarta bearing is shown being slipped onto landing gear strut. Below the strut are seen bronze bearings which are replaced by Micarta.

Cut from stock Micarta tubing, a tolerance of 0.002 inch is maintained. Bearings are 4 inches inside diameter by 4 inches long, with ⅜-inch wall.

Micarta

Quiet operation, strength and power to absorb shocks make Micarta best for this stoker gear and cam.

25 to 50% lower power cost—20 to 40 times longer wear than metal—no lubricating expense, with Micarta Steel Mill Roll Neck Bearings.

Resilience, smooth surfaces, resistance to mild acids and long life recommend Micarta Spinning Buckets for the Rayon Industry.

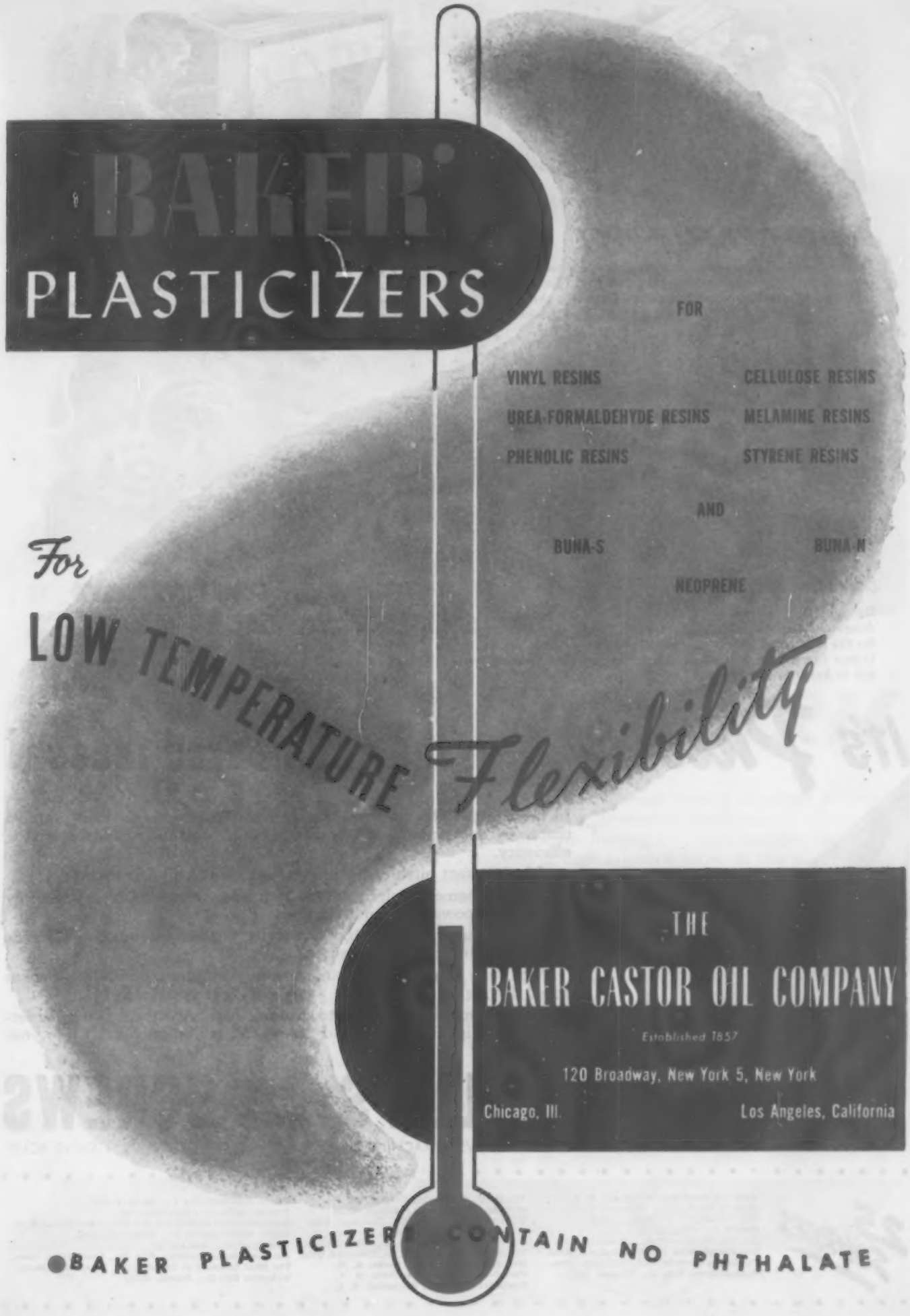
OTHER USES OF MICARTA

Airplane landing strut bearings made of bronze were too heavy—even after machining them to reduce weight. Now that strut bearings are made of Micarta, weight is cut 80% . . . production time is saved . . . maintenance and lubrication attention is reduced to a minimum.

Micarta is earning many new jobs—in many different industries—because of its rare combination of physical properties. Micarta reduces noise, resists corrosion, moisture, compression, impact, heat and cold. Micarta wears slowly and evenly . . . withstands vibration . . . flexes without fatigue . . . insulates like mica . . . and is easily fabricated to close tolerances.

If you need any of these qualities, write for your copy of the new Micarta Data Book B-3148-A, where they are explained in detail. Write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-06371-A


BAKER®
PLASTICIZERS
FOR
VINYL RESINS
CELLULOSE RESINS
UREA-FORMALDEHYDE RESINS
MELAMINE RESINS
PHENOLIC RESINS
STYRENE RESINS
AND
BUNA-S
BUNA N
NEOPRENE
For
LOW TEMPERATURE Flexibility
THE
BAKER CASTOR OIL COMPANY
Established 1857
120 Broadway, New York 5, New York
Chicago, Ill.
Los Angeles, California
●BAKER PLASTICIZERS CONTAIN NO PHTHALATE

SHUTS OUT SLIP-UPS!

Assembling baby furniture was mighty slow work with slotted screws, one manufacturer found. Too many scratches to refinish – scratches caused by driver skids. So to pick up production he switched to Phillips Screws...

FRIENDLY TO PROFITS!

... out went burred heads and driver skids and slant driven screws. Out went slow-as-molasses hand driving. In came power driving – and with it, savings in time and materials that sliced a big chunk off assembly costs.

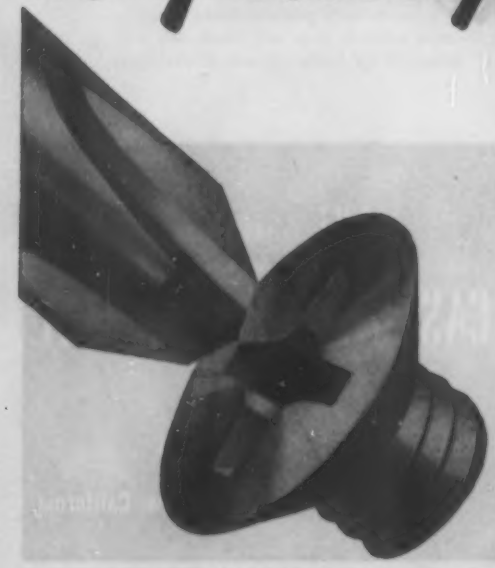
LONG ON SAFETY!

By making it stronger and more rigid, and by banishing dangerous burrs, Phillips Screws made this furniture safer for the kids. And your designers will find they do the same things for your product – whether it's tiny as a hearing aid or hefty as a harvester!

TOUGH ON COMPETITION!

Because of the ornamental design of the recess, Phillips Recessed Head Screws impart a "quality look" to any product. They give you a burr-free, blemish-free job that tells prospects you're on *your* toes – and warns competitors to watch out for *theirs!*

It's Phillips ... the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

... It's the exact pitch of the angles that eliminates driver skids.

... It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

... It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS *Recessed Head* SCREWS

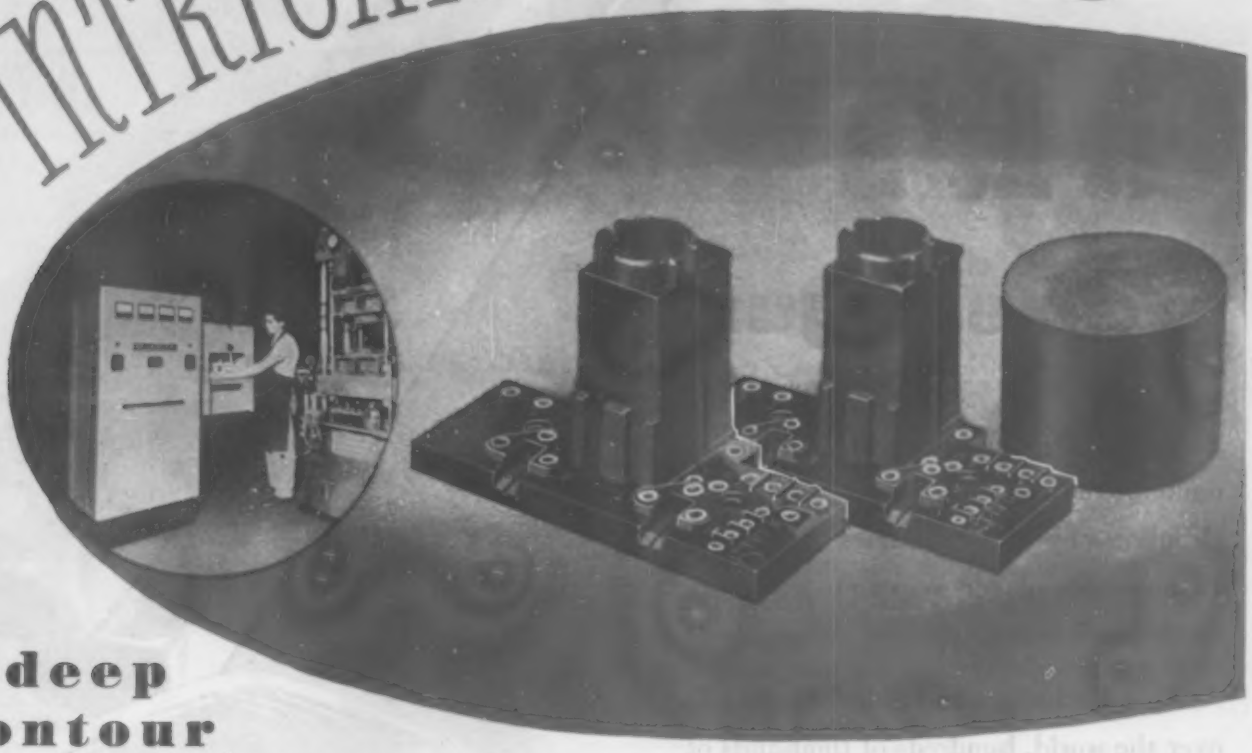
WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.

INTRICATE LOW PRESSURE MOLDING



• • •

a deep contour mold

21 *inserts—with* MEGATHERM*

Here again Megatherm high-speed through-heating of plastic preforms provided the solution to a knotty production problem.

Ordinary methods of preform heating . . . plus molding pressures up to 120 tons . . . resulted in high rejection ratios in this part because of its irregular wall-thickness, deep-draw, and 21 metal inserts.

Free-flow conditions produced in the mold by Megatherm uniform heating reduced rejects to a minimum . . . producing parts with a high gloss finish free from flash . . . and the metal inserts were clean and bright.

At the same time . . . molding pressure was reduced to *12 tons.*

More and more alert molders are recognizing MEGATHERM as indispensable to high-speed quantity production of normally difficult and costly parts on a sound commercial basis.

When* MEGATHERM *goes in . . . production volume goes up . . . and stays up!

Write now . . . on your company letterhead for complete data on MEGATHERM engineered dielectric heat.

FEDERAL TELEPHONE & RADIO — FTR

Federal Telephone and Radio Corporation

An IT&T Associate

Newark 1, N. J.

*Reg. U.S. Pat. Off.

G. I.'s
are clean guys

American boys (and girls) in uniform have undoubtedly set some sort of record for cleanliness by their purchases of Hemco-made plastic soap and tooth-brush boxes.

At Post Exchanges and Ships' Stores all over the world, hundreds of thousands of these sturdy containers have been bought.

These peacetime products, which thus became war materials, are produced by a plant that is 100% engaged in war production. Hemco injection molding facilities will again produce top quality peacetime products as soon as conditions permit.

THE BRYANT ELECTRIC COMPANY

HEMCO PLASTICS DIVISION

Molders of Compression and Injection Type Plastics

BRIDGEPORT 2, CONNECTICUT

A Subsidiary of Westinghouse Electric Corporation

HEMCO PLASTICS

MOLDING PLASTICS

Profitable Operation Calls for Accuracy with Speed

Cabinet-type Elmes self-contained plastic molding press with stroke control, adjustable pressure control, automatic time cycle, and push-button-actuated semi-automatic operation. Top and bottom knockouts. Bolsters, plates, and die supports, optional.

Pressure, temperature, time. These are three factors upon which successful plastic molding depends, yet their relative values are impossible to chart.

The *experienced* molder sizes up a job according to viscosities at the various mold sections, and he judges his pressure to suit. Gases and water vapor must not form porous areas while the resin is forced into and around the filler particles.

Experience helps to establish curing time. High preheat and mold temperatures accelerate polymerization. This calls for shorter operating cycles—for presses that economize on movement, function with split-second timing, and deliver the higher pressures such faster output requires.

There can be no substitute for *experience,* but *your* experience and *ours* must be stepping stones to further improvement. This is a responsibility we at Elmes are proud to share. Yesterday's Elmes presses were good; today's are better; tomorrow's will be even faster, more adaptable, and easier to operate.

Put your pressing problems up to Elmes. Nearly a century of building and applying hydraulic equipment is the background of Elmes service to plastic molders.

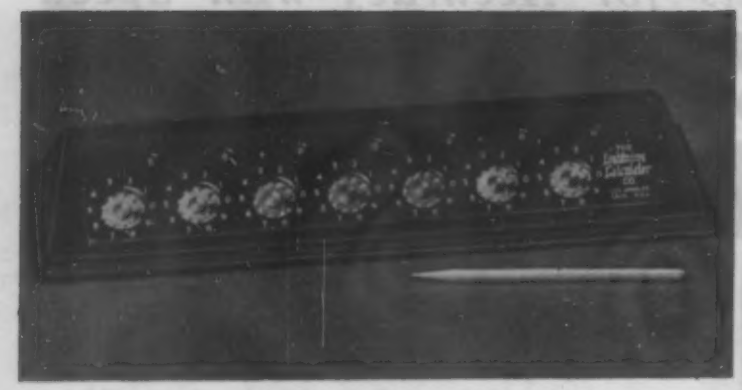
ELMES HYDRAULIC EQUIPMENT

ELMES ENGINEERING WORKS OF AMERICAN STEEL FOUNDRIES, 225 North Morgan St., Chicago 7, Ill.
Also Manufactured in Canada

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

MAKALOT

Can do your job better



K. E. M.—Makalot's less critical molding compound was employed by STORDAHL PLASTIC CO., West Los Angeles, California, to compression mold the new LIGHTNING CALCULATOR for the LIGHTNING CALCULATOR CO. of Los Angeles. The plastic base is both substantial and graceful, scientifically designed to hold the LIGHTNING at the right angle for comfortable desk work. Easy to operate, fast and accurate the calculator strikes out doubt and lightens work. Actual dimensions: Calculator and base 14" long, 4¼" wide and weighs 1½ lbs. Good looks back up the simplicity and ruggedness of this indispensable machine. STORDAHL PLASTIC CO. can well be proud of this excellent example of expert molding. Investigate K.E.M. for your less critical application.

MAKALOT RESINS

Makalot manufactures many general types of resins, each having numerous products developed for specific applications. MAKALOT offers a wide range of Resins for use in coatings, laminates, adhesives and bonds, available for low temperature and pressure applications as well as the usual thermosetting processes. Pictured on the right are $\frac{5}{16}$" Glider Floor Channels of 15 plys of Mahogany bonded with MAKALOT #85-X. This thermosetting adhesive can be cured on either the acid or alkaline side. It contains 90% solids and 10% alcohol, and can be diluted to proper consistency by use of alcohol. Makalot Hardener and filler is used to thicken it up when adhesive is used on the acid side. As supplied, Makalot #85-X is cured on the alkaline side and will require temperatures of approx. 200 to 235 degrees F. for proper curing. For laminating, insulating, oil soluble, water soluble, paper impregnating, protective coatings, etc. Investigate MAKALOT. UREA WATER SOLUBLE CREAMS—non-creasing for Textiles, Paper and Leather Industries, are available for wet strength paper, textile shrinkage control and finishes. UREA WATER SOLUBLE SYRUPS are also available. Remember, MAKALOT NEVER FAILS THE USER!!!

Domestic Representatives

CLEVELAND OFFICE
1900 Union Commerce Building

CHICAGO
332 South Michigan Avenue

PACIFIC COAST
Milton Turk
1855 Industrial Street
Los Angeles 21, California

PACIFIC NORTHWEST
Northwest Plastics Industries
415 4th and Cherry Bldg.
Seattle 4, Washington
921 Terminal Sales Building
Portland, Oregon

CANADA
Hobbs-Glass, Ltd.
54 Duke Street
Toronto, Canada

"KEEP 'EM MOLDING"

Makalot

CORPORATION

PLASTICS

622 Washington St., Boston, Mass.

The Producer of Superior Plastics

←Cost of finished pieces was reduced 40% by this RCA preheating unit at Kellogg Switchboard and Supply Company.
Telephone "cradle" molded by Kellogg; with cold molding, 4 press cycles per hour—with electronic preheating, 6¼ cycles.
↓

Kellogg Switchboard Reduces Cost 40% with Electronic Heat

Press Output Increased 56%; Molding Pressure Lowered; Warpage and Blistering Reduced with New RCA Automatic Plastics Preheater

Application: Kellogg Switchboard and Supply Company, Chicago, compression-molds a large quantity of telephone parts, including the "cradle" shown above. A four-cavity mold is used; each cavity takes 2 preforms weighing 1.75 ounces each. Material: Bakelite BM 2498. Molding Temperature, 320°F.

To step up production on this part, the Kellogg Switchboard and Supply Company installed RCA electronic preheating equipment. The complete charge of 8 preforms per mold is now preheated for 35 seconds to a uniform temperature of 220°F.

According to Mr. W. G. Cregeen, Assistant Shop Superintendent of the Kellogg Plant, electronic heating reduced the cost of finished pieces by 40%, and warpage and blistering, which were previously problems, are no longer troublesome.

	Cold Molding	Electronic Molding
Press Closing Time	1 min.	1 min.
Curing Time in Mold	5 min.	2½ min.
Press Cycles per Hour	4	6¼
Molding Pressure	125 psi	75 psi
Mold Damage		Less
Mold Life		Increased
Dimensional Tolerances and Stability		Better

RCA Equipment is Available! RCA's new compact 2000-watt electronic preheating unit for the plastics industry is available for quick delivery. Easy to install, completely automatic, it will heat a pound of average molding material to 275°F in 40 seconds, providing uniform plasticity throughout. The coupon below, or a letter, will bring you complete details. RCA application engineers are at your service. Address: *Radio Corporation of America, Electronic Apparatus Section, Box 70-195 P, Camden, N. J.*

RCA ELECTRONIC HEAT

BUY WAR BONDS

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION, CAMDEN, N. J.

SEND THIS TODAY FOR QUICK REPLY

RCA, Electronic Apparatus Section, Box 70-195P, Camden, N. J.

Please rush me free data on the completely automatic RCA electronic preheater, Model 2B, which is available for quick delivery. Also send "Data Form P."

Name.....

Company.....

Position.....

Address.....

City ..... Zone ..... State .....

Proved in Food Products! C. P. glycerine is a food itself, substantially equivalent in food value to carbohydrate. It has high sweetening power. No wonder it's used by so many manufacturers!

Proved in Cosmetics! C. P. glycerine's non-toxicity, emollient properties, resistance to evaporation, solvent power, and compatibility make it ideal for use in many cosmetics. Use glycerine!

Why Glycerine is a Superior Humectant: PERMANENCE

GLYCERINE as a humectant is permanent. Its permanence is a result of its low vapor pressure, its compatibility with hydrophilic materials, and its lack of tendency to "creep."

In the absence of a permanent humectant, glues dry out and are no longer adhesive and flexible; paper wrappings become dry and brittle; tobacco gives a less smooth and mellow smoke; cosmetics and dentifrices cake and crack; certain leather products become harsh and rough.

Does the adhesive on your scratch-pad or in a bookbinding become brittle? If so, the chances are that it has not been plasticized with glycerine but with some other material.

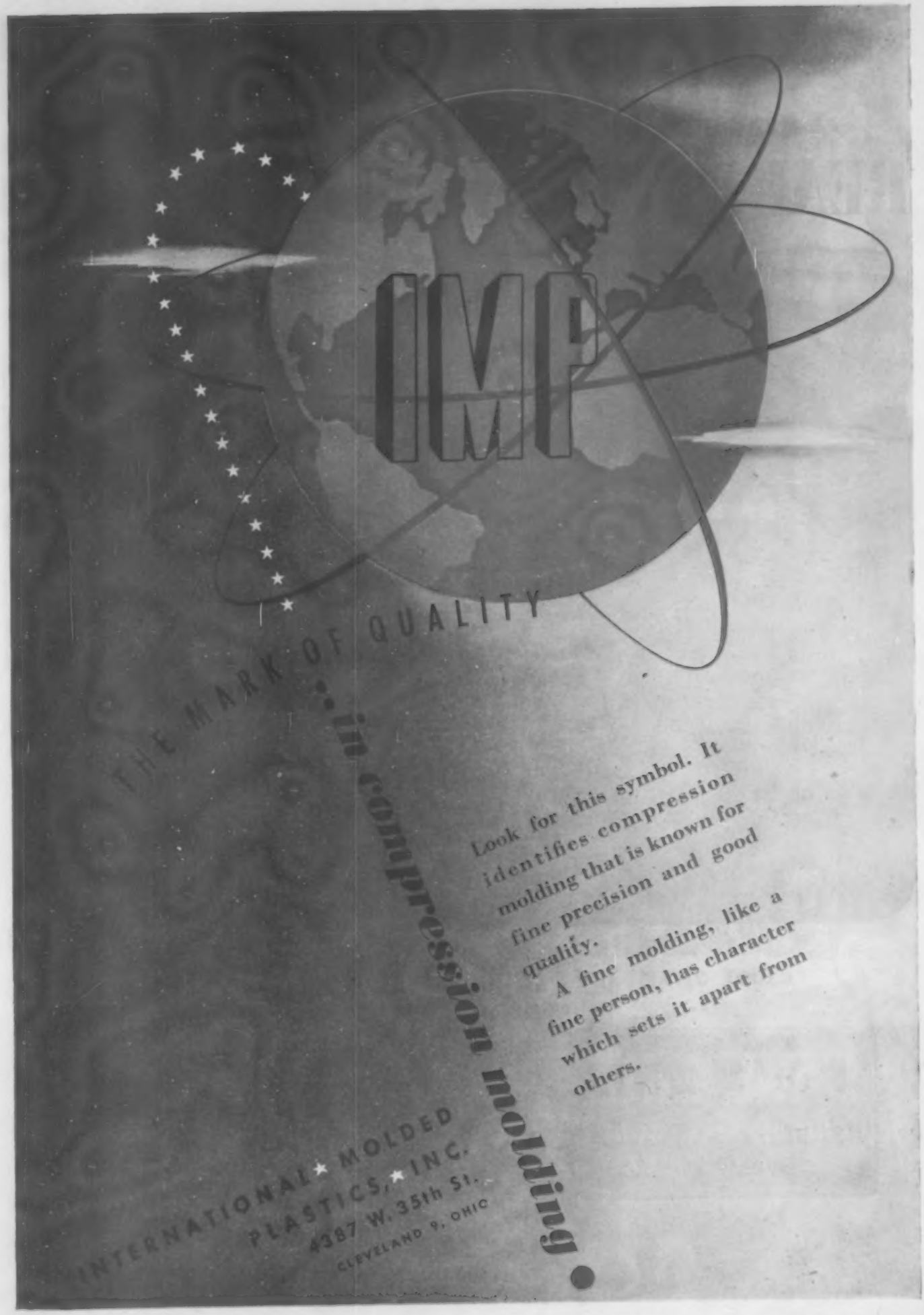
Glycerine is not only a superior humectant but a preferred plasticizer, solvent, carrier, preservative, lubricant, and key component in many essential products and materials. Its high viscosity, high solvent power, compatibility, non-toxicity, and other valuable properties can help you make superior products. Use glycerine, the time-tested ingredient, now freely available for the production of civilian goods. Glycerine Producers' Association, 295 Madison Avenue, New York 17, N. Y., Dept. J-8.

Proved in Medicines! C. P. glycerine, used as a solvent, carrier, and component of ointments, emollient solutions, plasters, and many other pharmaceuticals, is an old standby — proved safe.

Proved in Packaging! Because C. P. glycerine is non-toxic, it is used in the manufacture of transparent wrappings coming in contact with foods or food products. Use glycerine—and be sure!

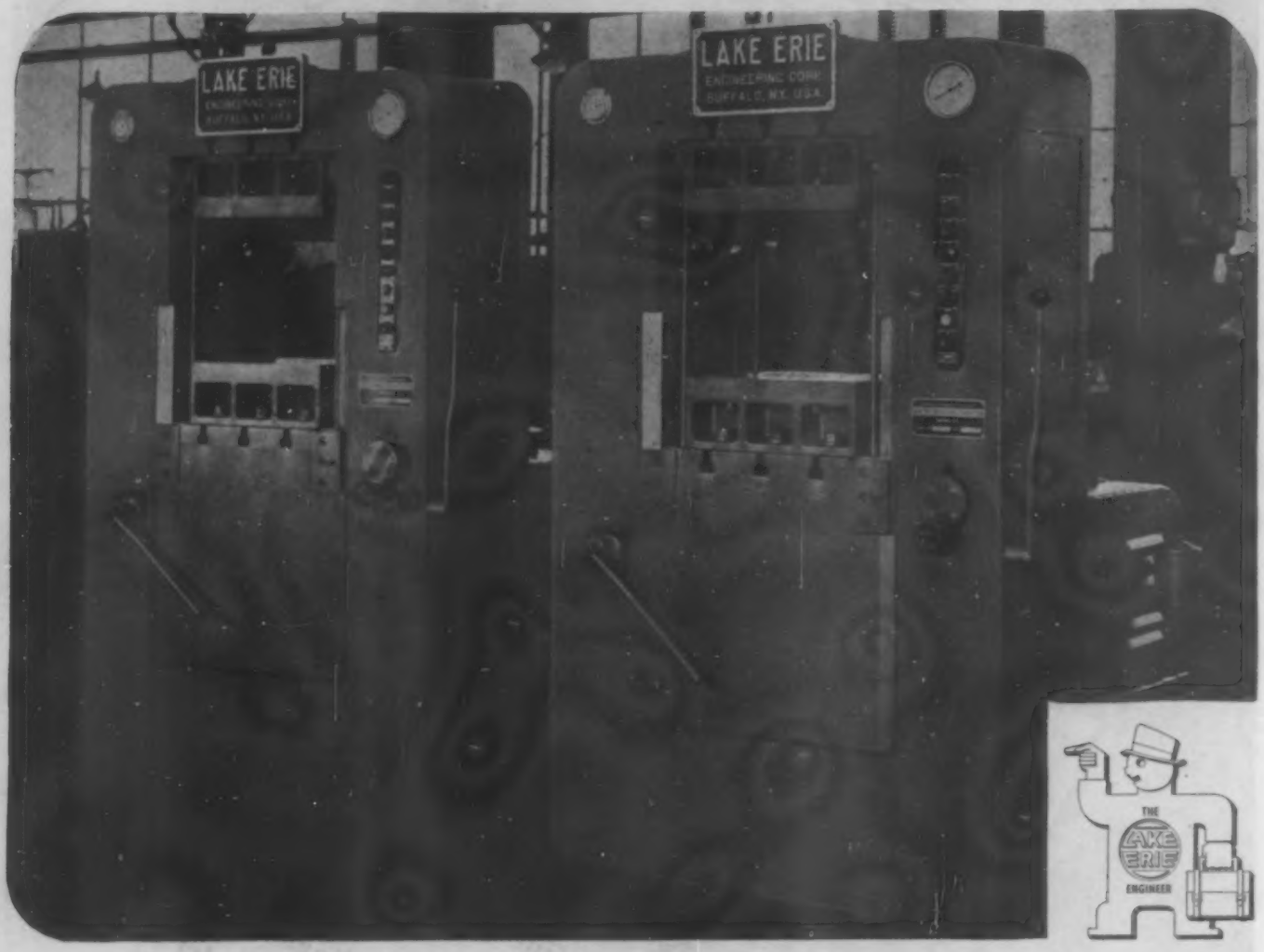
U. S. Navy Official Photo.

Tough Paints! Long-lasting paints for war equipment and for widespread industrial and home use have been made possible with alkyd resins, of which glycerine is an important raw material.


IMP
THE MARK OF QUALITY
...in compression molding
Look for this symbol. It identifies compression molding that is known for fine precision and good quality.
A fine molding, like a fine person, has character which sets it apart from others.
INTERNATIONAL MOLDED PLASTICS, INC.
4387 W. 35th St.
CLEVELAND 9, OHIO

CASE HISTORIES PROVING THE POWER OF THE PRESS

LAKE ERIE IS READY FOR THE PLASTICS AGE



LAKE ERIE self-contained, semi-automatic hydraulic presses offer many new developments for all types of plastic molding.

Illustrated are two of these latest presses of sixty tons capacity; 18″ x 16″ platens; 12″ stroke. These units have complete time cycle and full automatic push-button control, including adjustable plasticizing and breathing stroke.

Lake Erie is ready for the "plastics age". We can adapt standard presses to your compression molding needs or build special presses to your specific requirements. Write for information.

LAKE ERIE ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE ENGINEERING CORPORATION
868 Kenmore Station, Buffalo 17, N. Y., *Offices in Principal Cities*

Assembly TIME SAVERS!

ARO Pneumatic

NUT SETTERS and SCREW DRIVERS

Model 131 Impact Wrench. *¼" to ⅜" capacity. Reversible.*

Model 106 Impact Wrench. *¼" capacity. Reversible.*

Make your time-studies *now* on nut-setting and screw-driving operations with ARO Pneumatic Tools! Note the speed and big power of these small tools—with light weight that means less fatigue on assembly jobs!

Whether it's ARO Impact Tools designed with Controlled Torque . . . or other ARO models for all types of small tool jobs . . . you can count on ARO Performance to keep costs down and production UP! Write for catalog. The Aro Equipment Corporation, Bryan, Ohio.

Model 1011 Impact Screw Driver and Nut Setter *shown with No. 2 Phillips bit. ¼" capacity.*

Model 22LPH Straight Type Nut Setter. *Lever throttle. Capacity ¼".*

Model 22PAH Pistol Grip Nut Setter. *Capacity ¼".*

ARO

PNEUMATIC TOOLS

CONTINENTAL DIAMOND ENGINEERED *Plastic Materials*

The part illustrated is an airborne radio insulating part . . . made from grade "L" DILECTO . . . a laminated phenolic plastic. It was sawed, milled, drilled, countersunk and tapped. Tolerance requirements were close. DILECTO parts such as this one will be widely used in all branches of air transportation.

Here is a strong, tough plastic . . . with high electrical insulating properties that remain stable under extremes of temperature and humidity. DILECTO is readily fabricated on ordinary metal working tools. It is NON-corrosive and highly resistant to many chemicals.

This versatile plastic may be the answer to your "What Material?" problem. C-D technicians will be glad to help you find out. Their wealth of "Know-How," the result of a half century of service to industry, makes available to you thousands of case histories of solved design and operational problems.

C-D PRODUCTS

The Plastics

DILECTO—A Laminated Phenolic.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

DISTRICT OFFICES
NEW YORK 17 • CLEVELAND 14 • CHICAGO 11
SPARTANBURG, S. C. • SALES OFFICES IN PRINCIPAL CITIES

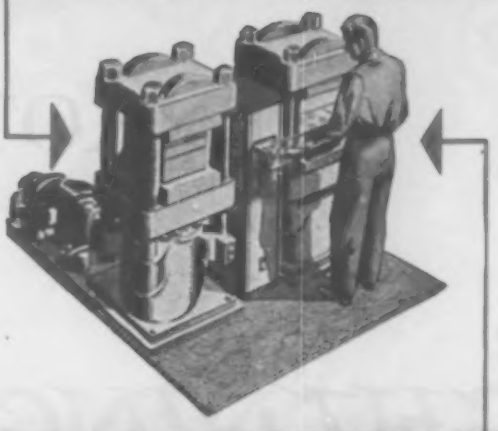
WEST COAST REPRESENTATIVES
MARWOOD LTD., SAN FRANCISCO 3

IN CANADA:
DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO 8

Continental Diamond FIBRE COMPANY

Established 1895. . Manufacturers of Laminated Plastics since 1911—NEWARK 28 • DELAWARE

Simple to install



Simple to operate

A BRAND NEW Thermex* RED HEAD

Always, you can depend on Thermex to make it simple as possible to use the advantages of high frequency heat in plastics molding. Here is a brand new member of the Thermex line developed especially for the plastics industry—a *slim* unit, only 13 inches wide. Just roll it between the presses and put it to work!

Like other Thermex models, it can be efficiently operated by unskilled help . . . just open and close a drawer. The high frequency energy automatically turns on when the built-in drawer heating compartment is closed, automatically turns off when the required temperature is reached. Compact as it is, this unit will raise the temperature of ⅔ pound of average material 170 degrees, uniformly, in one minute. Complete line includes models to handle ⅓, ⅔, 1⅓, 4, and 7 pounds of material on the same basis.

The Girdler Corporation
Dept MP-7, Thermex Division, Louisville 1, Ky.
Please send complete information about Thermex Red Heads.

Company.....

Address.....

Name.....

* A Girdler product—the first industrial high frequency dielectric heating equipment.

NORTON ABRASIVES

Your Latest Dividend From Coated Abrasives Research

1878
GARNET

1918
OPENKOTE

1932
LIGHTNING
(ELECTROCOAT)

DURABONDED
TRADE MARK

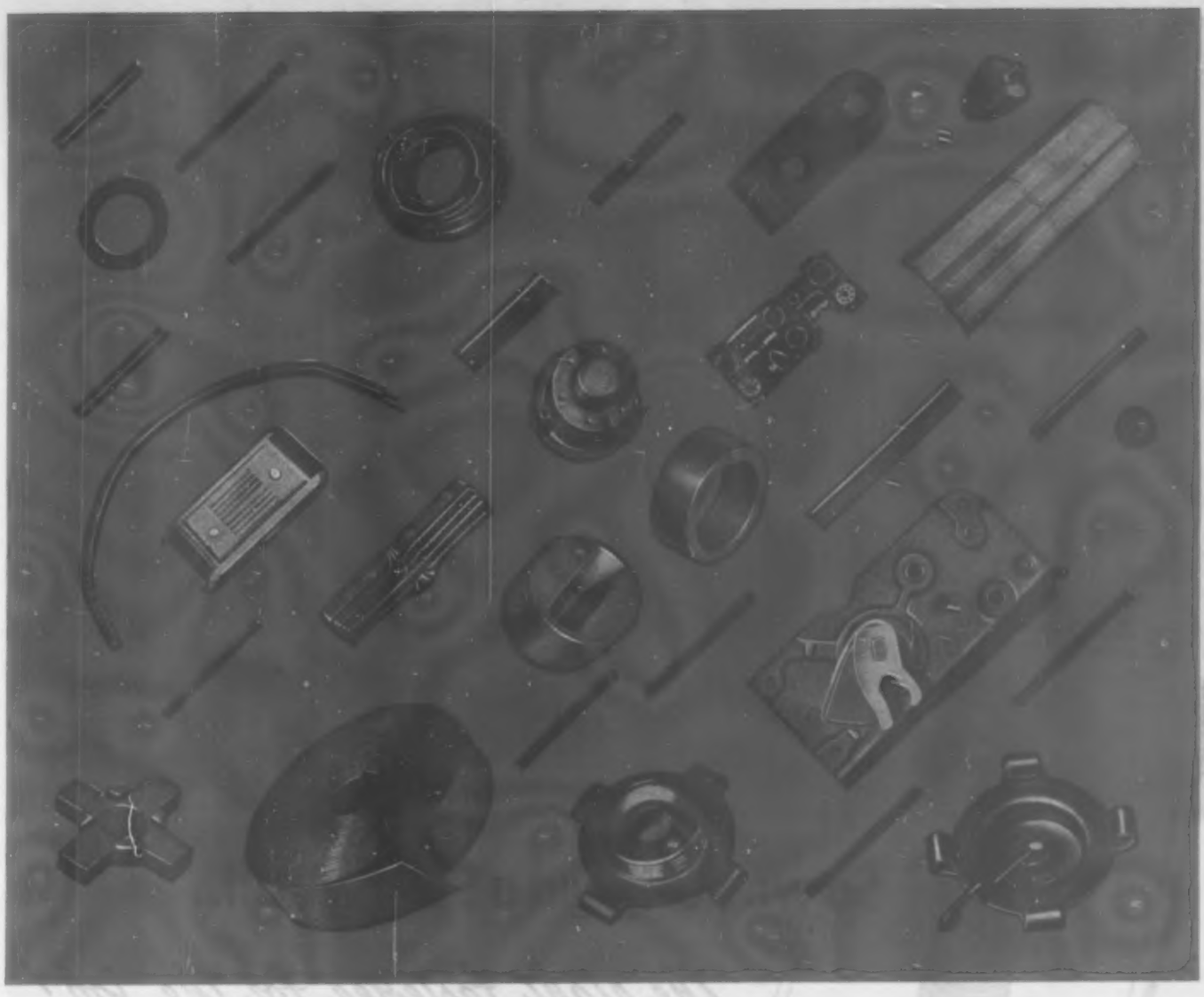
Its rock-hard adhesive bond, much more resistant to operating heat, much less sensitive to humidity, gives 25% greater output at no increase in price.*

If you have not yet experienced the outstanding advantages of DURABONDED Coated Abrasives, get in touch with our nearest branch for a prompt demonstration on the toughest job you can select.

This is a modest average. Many reports in excess of this figure are on file.

BEHR-MANNING
(DIVISION OF NORTON COMPANY)
TROY, N. Y.

BRANCHES: Boston, Buffalo, Chicago, Cleveland, Cincinnati, Grand Rapids, High Point, Indianapolis, Detroit, Los Angeles, New York, San Francisco, Philadelphia, St. Louis, Tacoma.



Not everybody

FEW manufacturers possess the versatile production facilities of The Standard Products Company.

Standard is prepared to develop and plan for industry, parts of molded rubber, steel stampings, plastics, in almost any shape or form.

The services of The Standard Products Company Research Laboratory and Engineering Departments are at your disposal. Let us have the necessary data and our engineers will submit designs and proposal.

The Standard Products Company is the world's largest manufacturer of glass run window channel and contour weather strip. Production and replacement channel for passenger cars, truck cabs, busses, motor boats, airplane cabins and streamlined trains is now available for delivery.

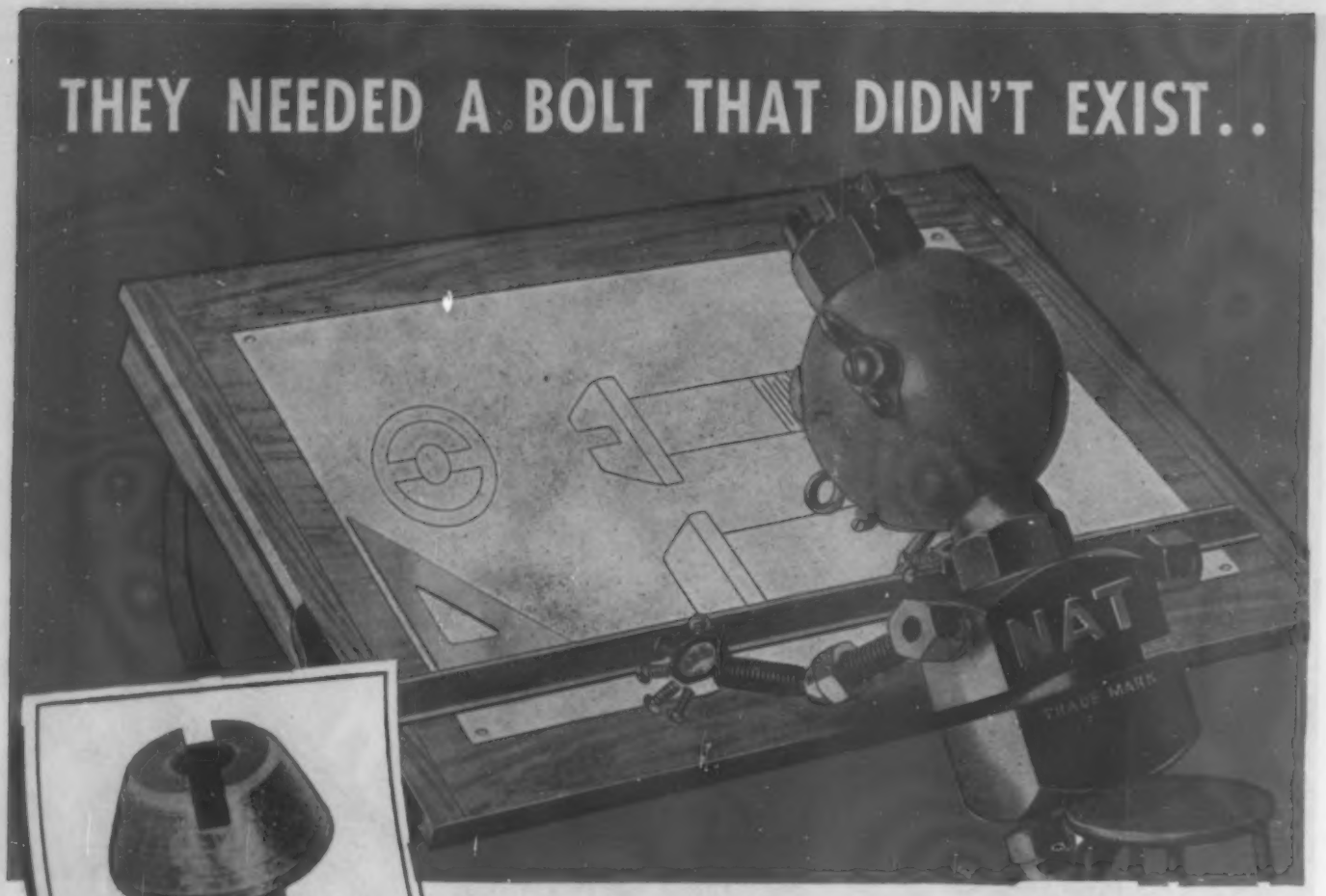
Your inquiries are solicited.

THE STANDARD PRODUCTS COMPANY

Administrative and Sales Offices

505 Boulevard Bldg. • Woodward Ave. at E. Grand Blvd. • Detroit 2, Michigan

THEY NEEDED A BOLT THAT DIDN'T EXIST..



So we designed a Special Bolt..

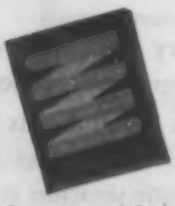
The right fastener for the job!

Here's another typical example of National's Technical Service—a special fastener designed for the particular application when standard fasteners don't meet the need:

In a certain rubber molding operation a bolt was required that could be pulled up tight and used for many applications. Extra large bearing surface was needed, as well as exceptional strength and high "torquing" capacity.

We designed the bolt of alloy steel, with a specially formed slot which permits use of a reinforced driver. This prevents slipping or shearing of the driver point. The large diameter at the base of the head affords ample bearing surface, while the tapered sides reduce the amount of metal in the head, making it possible to upset the bolt, an important cost factor.

You may need just such a service as this to improve your fastenings. Often we can save production time and cost by upsetting a part instead of milling from bar. Let us have your inquiry.



Send for a copy of this case history booklet describing briefly, with diagrams, typical instances of National's Technical Service. Ask for the "Savings" booklet.

National
HEADED AND THREADED
PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

MODERN PLASTICS
VOLUME 22 JULY 1945 NUMBER 11

Shoes—today and tomorrow

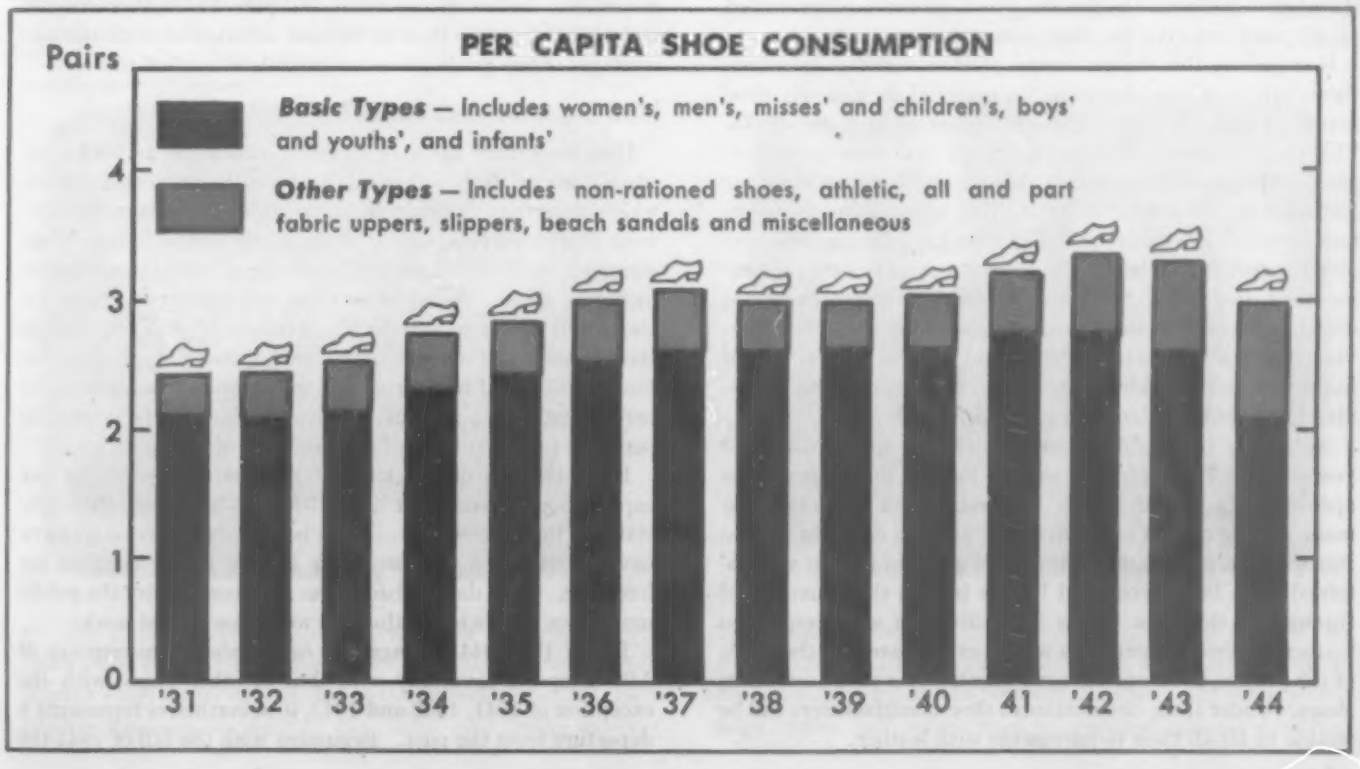
V-E DAY plus 5 years. This is the period in which plastics will have unparalleled opportunity to establish themselves in the shoe business, to show how well they can meet the exacting demands of this industry. In this period, while leather is yet scarce, plastics manufacturers will be able for the first time to meet the shortage with materials specially compounded for use in shoes.

Prior to the war, plastics were accepted materials in the shoe accessory field, in such parts as shoelace tips, ornamental buckles and arch supports. Plastic-coated fabrics were employed as quarter liners and insoles; synthetic resin adhesives were used for adhering soles to uppers. Sheet plastics had appeared as foxing, trim and saddles on two-tone shoes. Pyroxylin-coated wooden heels had an established place in the high-style field where heels of transparent plastics had lately made their appearance.

But for shoe uppers and soles, no plastics formulations had been developed prior to the war to a point where they met all the requirements of these two very exacting applications. Plastic soling materials were still in the laboratory and testing stage when our entrance into the war created a serious shortage in established shoe materials. The influx of hides from foreign countries was stemmed, the flow of rubber from the Far East was halted, and a large proportion of available leather and rubber was diverted to the production of military rather than civilian shoes. But the plastics which were called upon to supplement dwindling stockpiles of civilian shoe soling materials were themselves in short supply for non-military applications. For example, since the beginning of hostilities the vinyl resins, the family of plastics which constitute the basis of most plastic soling material, have been protecting important coaxial cables, serving as insulation on essential wiring in ships and aircraft, acting as waterproof and fungi-resistant coatings. In consequence, little but plastic scrap material has been available for use in shoe soling. Properly compounded and processed, this scrap has turned in a creditable record as soling material. But the soles fall far short of those which materials manufacturers know they can produce when plastic raw materials are freed from present war jobs.

The availability in production quantities of plastic formulations specially compounded to meet the requirements of soling materials should also serve to dispel the belief of some sections of the public that all the composition soles that have appeared on the market in recent years are plastic soles. The shoe hungry civilian and the raw material hungry shoe industry have been ready customers for certain dealers who have

CHART, COURTESY BOOT AND SHOE RECORDER



PHOTOS COURTESY SAKS 5TH AVENUE

1—Beach sandals and play shoes, the darlings of shoe-ration-conscious women, take on added charm when soled with colorful, and notably hard wearing, plastic material

2—Junior won't be wearing through his soles so fast when they are of plastic which have been found in actual wear tests to outwear even top grade leather as soling

compounded soling material from whatever scrap came to hand, stretching available resin with unwarranted quantities of filler. While these compositions have proved adequate in certain applications—in beach sandals, for example—they have too often been employed in shoes that require greater wearability and flexibility in their soles. In these applications and masquerading under the name "plastics" they threaten to discredit the service which properly compounded plastic soles can give the shoe industry.

Recognizing this danger, many plastics material manufacturers are even now stamping the material they supply shoe manufacturers with identifying trade names or trade marks. This practice promises to become more and more general as plastic raw material supplies are liberalized by cutbacks in war contracts and manufacturers are free to produce the compounds which laboratory and field tests have shown to be best able to meet the varied and somewhat contradictory requirements of shoe soles. Such marks should serve two purposes: direct customers to shoes with the same soles that had previously given satisfactory service and prevent the failures of improperly compounded composition soles from being associated in the public mind with plastic soling materials.

According to reliable reports it will be approximately 5 years before the supply of leather for use in civilian shoes aproaches its prewar level. A combination of factors has made drastic cuts in our own herds, and the cattle of central Europe from which some of the finest grade of leather was obtained have been decimated by the battles that have raged throughout this area. This tight situation with respect to leather for shoe construction will be exaggerated by the needs of the peoples in all war-ravaged countries for shoes, and more shoes. Under these circumstances shoe manufacturers will be unable to fill all their requirements with leather.

As most industry turns from war to the battle of civilian competition, the shoe field faces a period of leather scarcity. This gives the plastics industry an opportunity to work out on a production scale the problems peculiar to the shoe business. It will have additional time to modify the findings of the laboratory with experiences of large numbers of wearers, to instruct shoe manufacturers in the proper handling of its materials. And most important, this period of leather scarcity will give the public time to become acquainted with the advantages of top grade plastics materials as applied to shoes.

How big is the shoe market?

How important the shoe industry can be as an outlet for plastic materials is indicated by recently published figures which show that the average American's expenditure for footwear represents two percent of the entire cost of living. This compares with the 12 percent spent for all wearing apparel—including shoes. As might be expected, the expenditures for shoes bulk larger in the clothing budgets of children than in those of men and women. Thus, men spend 12 percent of the moneys allocated to wearing apparel on shoes, and women 10 percent, while 22 percent of boys' clothing budgets and 20 percent of girls' go toward the purchase of footwear.

It needs but a quick glance at the chart (page 93) of per capita shoe consumption since 1930, to show how inherently stable is the shoe market. Even booms and depressions have never produced a commensurate change in the demand for footwear. Good days or bad, shoes are a commodity the public must have if it is to continue to work—or to find work.

But if the 1944 average per capita shoe consumption of 3.06 compares favorably with that of other years, with the exception of 1941, 1942 and 1943, it nevertheless represents a departure from the past. Beginning with the fall of 1943 the

TABLE I.—ESTIMATED PERCENTAGE OF LEATHER AND NON-LEATHER SOLES IN SHOE PRODUCTION[a]

	1941		1942		1943	
	Leather	*Other*	*Leather*	*Other*	*Leather*	*Other*
Men's dress	86.1	13.9	91.6	8.4	81.7	18.3
Men's work	49.2	50.8	57.3	42.7	33.7	66.3
Women's	85.8	14.2	88.4	11.6	74.1	25.9
Youths' and boys'	43.7	56.3	52.1	47.9	37.1	62.9
Misses' and children's	77.3	22.7	81.4	18.6	69.3	30.7
All civilian types	75.5	24.5	83.3	16.7	69.6	30.4

[a] Compiled by Boot and Shoe Recorder.

proportion of *basic types* to *other types* (page 93) has undergone a marked change. Prior to 1944 these *other types*, had never accounted for more than 15 or 20 percent of the total shoe output. But, with shoe inventories reduced by approximately 65 million pairs between April 1943 and July 1944, consumption of non-rationed footwear, which includes women's street shoes, play shoes and a variety of footwear gaining acceptance for informal dress as well as street and play use, increased almost 100 percent. As can be seen from the final column in the chart on page 93, these *other types* accounted for a third of the civilian footwear in 1944.

There is no means of knowing the exact role of plastics in this category of non-rationed shoes just as there is no way of distinguishing between the *basic type* shoes that are soled with leather and those soled with plastic compounds and other non-leather materials. Yet such straws in the wind as Table I must serve to indicate the decline in leather shoe soles which first became evident in 1943 and the attendant increase in non-leather soles.

According to figures made public by the National Shoe Manufacturers' Association, production of leather shoes for civilian use in 1944 approximated 240 million pairs. This was supplemented by about 85 million non-leather, bringing the total number of outdoor shoes produced for use by civilians in 1944 to 325 million pairs. And this production was inadequate by at least 50 million pairs.

Today's tight situation with respect to leather has been further exaggerated by the Army's stepped-up orders for combat boots which use in each pair as much leather as is

***3**—The color effects which can be achieved in sports shoes through the use of sheet plastic for the saddle and heel trimming are almost endless in their variety*

***4**—For the soles, for the uppers, for the trim; in sport shoes, in street shoes, in evening slippers. Such is the field for plastics in today's footwear for women*

COLOR PLATES, COURTESY BAKELITE CORP.

***6**—The gayety, lightness and sparkle of night life has been captured in evening slippers fashioned from transparent vinyl material. And not the uppers alone, for the plastic appears as well in the soles and frothy bows*

***5**—The platform sole and plastics. So well do the two work together that each might have been introduced to the shoe industry to complement the other. The new rolled edge takes full advantage of colored plastic sheeting*

MATERIAL, B. F. GOODRICH CHEMICAL CO., FINISHED PRODUCT, B. F. GOODRICH CO.

7—Winter and summer, women are demanding more and more color in their footwear. Typical of this trend are these black suede walking shoes with bright red plastic soles and the white oxfords with their blue soles and striking red saddle and trim

needed for three pairs of civilian shoes. Taking all factors into consideration, it is anticipated in shoe circles that there will be 30 million fewer pairs of leather shoes than there were in 1944. Adding to this 1945 shortage of 30 million pairs of leather shoes the 50 million pairs by which 1944 production fell short, it is evident that there will be a need for at least 80 million more non-leather outdoor shoes in 1945 than in 1944, or a total of about 160 million non-leather shoes.

Figures on postwar shoe production vary by as much as 100 million pairs, vacillating between 500 and 600 million pairs a year. The lower figure of 500 million pairs is based on the belief that the end of the war will see a wave of spending as a reaction to the long years when there was all too little on which money could be spent. The higher figure of 600 million pairs takes into consideration the need of most individuals to rebuild their depleted shoe inventories.

Effects of war period carry over

But however uncertain the volume of production, there is no doubt that the type and quality of our future shoes will for long show the influence of the war years. Already there is a trend toward more comfortable and better fitting shoes. In line with the public's increased consciousness of quality, durability can be expected to be an important factor in the shoe business. Style will, without doubt, play much the same role that it did before the war.

Price is still an indeterminate factor. Rationing has had an adverse effect on the demand for shoes in the lower price brackets. As long as the consumer income represents a tremendous potential demand and rationing on a pairage basis continues, the sales of high-priced shoes are bound to be better than in so-called normal times. But in time, this trend will no doubt subside and price will once more play an important, if not dominant, role in the retail shoe picture.

These are the elements—comfort and fit, durability, style and price—upon which plastics as applied to shoes must concentrate if they are to figure permanently in the shoe industry. Whether it be insoles, uppers or heels, plastics must equal the standards established for these applications by leather—and offer a few advantages all their own. The idea is not to supplant leather in shoes. The ultimate intention is, rather, to use leather and plastics in combinations which will make the best use of each material. But to achieve this goal, shoe manufacturers accustomed through long years to the properties and handling characteristics of leather in the soles and uppers must be offered something better than "just as good."

Plastic soles

The synthetic soles that appeared on the market in 1941 and 1942, while handicapped by the fact that only scrap plastic materials were available for civilian applications, yet benefited from the fact that work on the adaptation of plastics to shoes had been started in the laboratory as early as 1936. The types of materials best suited for use in soles, methods of compounding and forming, means of application and the properties essential in soling materials had been established—at least in the main. What was lacking in 1941 was a period in which the laboratory-proved materials could be given extensive wear tests and modified on the basis of reports coming in from the field.

Since then, at least one plastics material manufacturer has submitted his vinyl soling material to such a field test. Children's shoes were made up by this company and distributed to retail shoe stores throughout the country. The names of purchasers were carefully noted. Weeks later these families were contacted for their reactions to the newly introduced soles. "How long have the shoes been worn? Are the soles still in good condition? Any holes? Worn down on either side or at the front edge? How do the soles compare with other types worn by the same child?" While the majority of replies were high in their praise of the wear of these vinyl soles, the critical responses were perhaps the most valuable, indicating as they did just which properties of the soling material needed further improvement. For example, several mothers complained that the soles separated from the uppers. "The sole broke where it was stitched on one foot after about 3 weeks of wear," read one letter describing the shoes worn for about 10 weeks by a 7-year-old girl. Another criticism concerned the inability of these vinyl soles to be half soled. The idea was that children outgrow the shoes too rapidly to justify the expense of full soles.

As for the material for synthetic soles, most of the investigation has been confined to what is called the thermoplastic type of plastic material. With few exceptions today's plastic soling material has a vinyl resin base—either polyvinyl chloride or polyvinyl butyral. Recently, novelty shoes with soles and heels fabricated from cellulose acetate sheet stock have appeared on the market. Experience has indicated that

one of the causes of failure in plastic soles is the use of improper or of too much filler or plasticizer. It is an established fact that in most thermoplastics, inert or fibrous fillers weaken rather than reinforce the material. In consequence, failures occur more readily in those compounds employing the greatest quantity of filler.

Today, plastic soles are produced by calendering, extrusion or molding. It is understood that all three types can be processed on standard shoe machinery with only slight, easily learned modifications of procedure. Thus the principal manufacturing problem lies in instructing experienced leather men in the ways in which plastics handle differently from leather and in giving them enough training so that they instinctively work plastics correctly just as they do leather. One of the few criticisms heard by shoe manufacturers relates to the difficulty experienced in getting plastics companies to produce their materials in thicknesses easily translated into irons. (Irons are the standard measurement of thickness in the shoe industry; one iron equals $^1/_{48}$ of an inch.)

Essentially, standard methods are followed in attaching plastic soles to shoe uppers. These soles may either be stitched or cemented in a manner similar to leather soles. Then there is the welt sole construction in which the plastic soles are laminated to inner soles and then stitched directly to the welt. The newest method of attachment is that in which the plastic sheet is rolled over the edge of the midsole to give a platform effect. For best results, some of this plastic soling material needs a split leather backing to facilitate attachment.

Our contact with most possessions, even our most personal ones, is somewhat fleeting. And if, for the moment, they displease we can toss them aside or walk away. It is another matter with all types of wearing apparel. Day in and day out —and for the greatest portion of each day—we are in constant contact with the materials that go into our clothing. Therefore, material standards are of the strictest.

Obviously the plastics that go into soling should have optimum physical properties. The most important of these are tensile strength, tear resistance, stitch tear resistance, abrasion resistance, water absorption, hardness and low temperature flexibility. The article, "Properties of vinyl shoe sole materials" which appears on page 100 of this issue, indicates how various compounds available during the war years meet the standards which have been established for soling material.

From all reports—from the consumer, retailer and manufacturer—there is no question of the ability of properly compounded synthetic soling material to outwear even top grade leather. This property is perhaps most important in the soles of young people's and children's shoes, and in women's and men's street shoes. In high-style shoes, on the other hand, wear is a somewhat minor consideration.

Flexibility at low temperatures has been the property hardest of achievement particularly in men's shoes which present broader soling surfaces than do the shoes of women and children. According to one plastics material manufacturer low-temperature flexibility tests should indicate more than the lowest temperature at which soling will bend without cracking or fracturing. They should also evaluate a material's ability to resist stiffening at reduced temperatures. According to this company, a properly compounded sole should not stiffen appreciably at temperatures as low as −20° F. but may fracture at −40° F. But with this flexibility there should be a minimum of elasticity. Otherwise the soling will tend to work the bottoms of the feet as do some rubber soles.

The resistance of all these plastic soles to water is, like the remarkable abrasion resistance of these materials, a point of superiority over leather. Anyone who has been caught in a downpour, without rubbers, when wearing leather soles can appreciate this last characteristic.

And finally there is color—again a point where plastics show superiority over leather. In view of the belief expressed by a

PHOTO, COURTESY U. S. STONEWARE CO.

8—The adaptability of plastics to women's shoes is best exemplified by the varied uses to which these materials can be put. Here they appear in the soles of play shoes, the trim and soles of summer pumps and in the soles of some afternoon slippers

PHOTO, COURTESY ASSOCIATED STYLISTS

9—Smart and practical is the suggestion of one stylist that plastic coated yarns be used as applique on uppers

PHOTO, COURTESY FIBERFORM INDUSTRIAL PRODUCTS CO.

10—These prewar slippers suggest the adaptability of fabric woven from plastic monofilaments to shoe uppers

PHOTO, BAKELITE CORP.

11—High gloss vinyl sheeting bids fair to be among the most popular applications of plastics in shoes

representative scattering of retailers that the biggest market for plastic soles will be in the women's and children's shoe fields, the ability of these materials to be produced in almost any shade and tone should prove a strong selling point. The trend toward the matching of shoes to millinery or to the basic costume colors rather than to the handbag is a style that is made to order for plastics. There is even the suggestion that brightly patterned material might be laminated between sheets of transparent vinyl shoe soling material as a novelty effect.

While cost does not bulk so large at the present time, in the years to come when shoe materials of all types are in ample supply it will without doubt have a decided influence on the amount and type of plastics used in shoes—in uppers and heels as well as in soles. In the high-priced field material is not the biggest factor in the retail price. The important costs are attributable to finishing and style. However, the weight of these two elements decreases with each downward step until they are rather negligible factors in the very lowest-priced shoe field. In contrast the cost of materials bulks very large in cheap shoes and, if plastics are to compete in the low-priced field after the war, they must match competing materials as far as price is concerned.

The shoe uppers of the future

As mentioned previously, because of our constant close contact with the materials that go into wearing apparel, requirements for these materials are of the strictest. This is even truer of the materials employed in shoe uppers than it is of soling compounds. Perhaps because of this, perhaps because the most severe shortages early in the war were of soling materials and research naturally centered in the solution of that difficulty, a plastic material is not yet available to the public in commercial quantities which meets all the requirements for the upper of a street shoe.

As early as 1940 transparent sheets of vinyl resin were used in the uppers of afternoon and evening shoes. Since then fabric woven from plastic coated yarn has proved popular in cut-away evening and summer shoes. And mention might be made of a limited number of women's street shoes—test shoes in a sense—which were constructed with uppers woven from extruded plastic monofilaments. Today uppers of high-gloss vinyl sheeting are starting to make their appearance and bid fair to be among the most popular plastic shoe applications when vinyl is once more in free supply.

Despite the extensive field work which has been done, for example, on high-gloss vinyl sheeting, the use of synthetic materials in shoe uppers is still in the development stage. The problems are many and varied. There is, for instance, the question of breathing. And even this question is in dispute, many shoe men insisting that the important factor is the ability of upper material to absorb moisture. Be it breathing or absorption, solid sheets of plastics alone possess neither quality. Consequently their use in closed shoes presents numerous difficulties. Perforations offer one solution, another is the adoption of an open toe and heel design. Materials woven from plastic-coated yarn and from extruded monofilaments, being open meshed, can be used in shoe uppers without concern for this particular requirement. However, by reason of certain developments in shoe construction, the moisture absorption rate of certain vinyl sheet materials has been brought to a point where closed shoes made with this material are said to be as comfortable as the old patent leather shoe.

Just as in plastic soles, flexing is an important property of any plastic material intended for use in shoe uppers. The ability of upper material to expand but not stretch is also

PHOTO, COURTESY CELANESE PLASTICS CORP.

12—*Lightness and air are one with these novelty shoes which are completely plastic even to their ties. Both the soles and heels are fabricated of cellulose acetate*

13—*Almost limitless is the color range in these plastic heels. The method of injecting cellulose acetate over wooden heel cores was only recently made public*

essential if the material is to conform to the contours of the foot—a must for everyday walking shoes. This characteristic is also important to the shoe maker, for upper material must hold its shape when lasted and not snap back to its original shape. To achieve this end plastic intended for use in uppers —whether it be in sheet form or woven from monofilaments— is most often backed with some such material as cotton.

Again color can be expected to play an important part in the popularity of these materials. There is in addition the variety offered by the almost endless surface patterns which can be achieved in both sheet plastics and in fabrics woven from plastic-coated yarns and from monofilaments. In all the work done in this field the objective has not been to imitate leather, but to create new materials which meet needs neglected or beyond the range of older shoe materials.

Even before the war, sheet plastics enjoyed wide use in foxing trim and saddles. Again the colors in which plastics can be produced account for much of their popularity in this application. But their water-repellent and scuff-resistant characteristics are of equal importance. Use of plastics for trim is closely allied with the suggestion of one well-known shoe stylist that a big field for plastics in uppers lies in their use as applique. The shoes shown in Fig. 9 illustrate this type of application. Like all plastic uppers, and heel and toe covering, such scroll work needs but the swipe of a damp cloth to make it clean.

Just how big a role plastics will play in shoe uppers awaits the day when plastic raw materials will be freed from their present war jobs. Then, with men available to devote their full time to research work on plastics as related to footwear, women's shoes in particular should flash forth in the full colors that plastics alone can offer.

Heels—clear and in color

The use of plastics in shoe heels is well established—pyroxylin-coated heels, clear and colored heels fabricated from acrylic resin and cellulose acetate. Only recently a method of injecting cellulose acetate over wooden heel cores was announced to the public,[1] and the injection molding of the heel integral with the support of the shoe is also understood to be under investigation.

Color and the novelty effects which can be obtained through the use of plastics in heels suggest that the big field for this application will continue to be women's shoes. Postwar developments may, however, completely change this picture.

Inner sole, quarter sole, ornamental buckles—the list of additional plastic shoe applications could go on and on. However, the foregoing summary of the present and future role of plastics in shoe soles, uppers and heels should indicate how large the shoe industry can bulk as a potential customer for plastics materials.

What the Army is doing

The civilian market has thus far been our sole concern in this article. The following paragraphs should serve to round out the picture, give an inkling of the use the Army has made of plastics in military footwear.

Before the Synthetic Rubber Program had been clearly established the principal problem known to exist on Army footwear was that of developing a longer wearing sole and heel. Among the materials contemplated for trial were cellulose acetate, polyvinyl chloride, and polyvinyl butyral; of these polyvinyl butyral was tested for use on heels and the vinyl resin for use on soles.

Since laboratory abrasion results do not necessarily correspond with field results, polyvinyl chloride and polyvinyl butyral were tested at the Quartermaster Board. The Board has a shoe track of approximately $^1/_2$ mile in length composed of many different materials including sand, cement, gravel, small rocks, logs, mud and water. The test shoes were worn only on this track so that a definite comparison could be made between various materials. In addition, experimental shoes were issued to troops in (*Please turn to page 192*)

[1] "In Step with Fashion," MODERN PLASTICS *22*, 114 (Nov. 1944).

Properties of vinyl shoe sole materials

by G. M. KLINE, P. A. SIGLER and P. PLAIA*

The public has heard and seen a great deal of plastic soles during World War II. The critical supply situation with respect to sole leather, attributable to both increased demands by the military services and dependence to a large extent on foreign sources for hides and tanning materials, has made it necessary to seek replacements wherever possible. One type of material which has been found to have suitable properties for this application is vinyl resin. Unfortunately this synthetic material is also in very critical supply. However, scrap—available from the manufacture of insulation for wire and cable—has been employed for the production of shoe soles.

TWENTY-TWO vinyl plastic materials were evaluated for use as shoe soles at the request of the War Production Board, and data suitable for use in writing a specification for vinyl plastic to be used for shoe soles were obtained. The materials were submitted by various manufacturers between Dec. 15, 1943, and Feb. 11, 1944. The samples are described in Table II.

Tests were made to determine thickness, density, tensile strength, elongation at break, stitch tear, change in thickness on immersion in water, loss in weight on heating, flex fatigue life at 32° F., resistance to cracking on bending at 0, −20 and −40° F., and abrasion resistance, by means of the Taber abraser and the National Bureau of Standards leather abrasion machine. The materials were conditioned at 70° F. and 65 percent relative humidity, and the tests were made at these conditions unless otherwise indicated.

Methods of test

Thickness—Measurements of thickness were made with a dial gage. The diameter of the foot was $^3/_8$ in. and the load was one pound.

* National Bureau of Standards.

Density—The density was determined from the dimensions and weight of 4 specimens, 5.0 by 9.8 cm., cut from the sheets with sharp steel dies and a press. This is in accordance with Method No. 5012 of Federal Specification L-P-406a.

Tensile properties—The tensile strength was determined for 3 specimens cut in each of the two principal directions of the sheet, substantially in accordance with the "dumb-bell method" of the American Leather Chemists Association procedure for "Measuring the Tensile Strength of Leather." The test specimen, cut with a steel die, was $1^1/_4$ in. wide at the ends with a reduced section in the center $^1/_2$ in. wide for a length of $2^1/_2$ inches. The tests were made on a pendulum-type testing machine. The jaw through which the load is applied travels, when unloaded, at a uniform rate of 12 in. per minute. The elongation at break was determined on a 2-in. portion of the reduced section with a pair of dividers.

Stitch tear—The stitch tear was measured for 2 specimens cut in each of the two principal directions of the sheet in accordance with Method *D* of the American Leather Chemists Association procedure for "Measuring the Tearing Strength of Leather." The specimen was 2 in. long by 1 in. wide. A $^1/_8$-in. diameter hole was drilled $^5/_{32}$ in. from one end with the center of the hole on the longitudinal center line of the specimen. The specimen was fastened between the prongs of a yoke by means of a piece of No. 13 Birmingham gage (0.095 in. diameter) steel wire threaded through the hole in the leather and the holes in the two prongs of the yoke. The opposite end of the yoke was clamped between the jaws of a tensile testing machine and the free end of the test specimen between the other set of jaws of the machine. The force required to pull the wire through the specimen was measured. The stitch tear per inch of thickness was calculated from the tearing force and the thickness of the piece. The tests were made on specimens (*Please turn to page 188*)

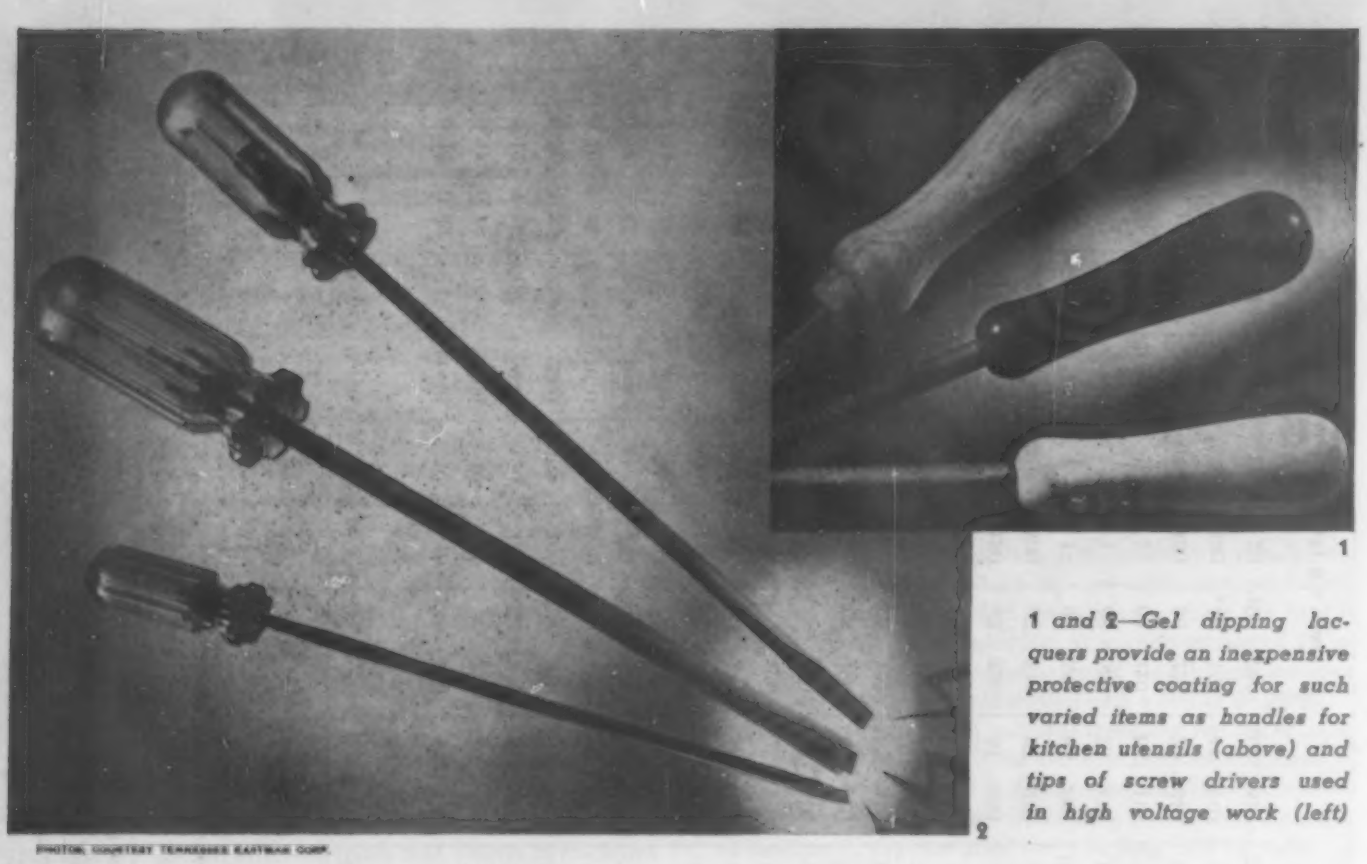
1—Abrasion resistance of leather is measured on an apparatus consisting essentially of a vertical wheel. Twelve test specimens set on its circumference make contact with abrasive paper mounted on a horizontal disk

2—A Taber machine which is used for determining the abrasion resistance of plastic materials. Special CS-17 wheels and additional weights are employed to bring the weight of each individual head up to 1000 grams

TABLE I.—PHYSICAL PROPERTIES OF VINYL PLASTIC SHOE SOLE MATERIALS

Sample designation	Average thickness	Density	Tensile properties[a]				Stitch tear								Thickness[b] change on 4-hr. immersion in water at 70° F.	Loss in weight on heating at 180° F. for 72 hr.	Flex fatigue life at 32° F. on 0.5-in. I.D. bend, unaged	Bend test[c]						Abrasion resistance[a]	
			Average strength		Elongation at break		Dry				Wet							on 0.5-in. I.D. at 0° F.		on 0.5-in I.D. at −20° F.		on 0.5-in. I.D. at −40° F.			
			Direction A	Direction B	Direction A	Direction B	Direction A		Direction B		Direction A		Direction B					Unaged	Aged	Unaged	Aged	Unaged	Aged	Leather machine	Taber machine, CS-17wheel
	in.	g./cm.³	lb./in.²	lb./in.²	percent	percent	lb.	lb./in. thickness	lb.	lb./in. thickness	lb.	lb./in. thickness	lb.	lb./in. thickness	percent ±0.8	percent	Number of flexes before failure									rev./mm.	mg./1000 rev.
1	0.16	0.69	1480	1440	10	10	40	250	86	330	53	260	48	300	−1.5	2.6	.....	P	P	B	B	..	..	7,200	22
2	0.15	0.79	1680	1500	10	10	52	350	36	240	39	260	37	250	−1.6	1.6	.....	C	C	C	C	..	..	3,800	113
3	0.12	1.26	1230	940	120	130	25	210	26	220	28	230	30	250	+1.2	1.7	1,500	B	B	..	..	..	..	5,100	96
4	0.20	1.30	2330	2200	160	160	104	510	104	520	84	420	108	540	−0.2	0.2	5,000	P	P	B	B	..	..	7,700	20
5	0.16	1.26	1530	1070	150	110	46	290	54	340	53	330	62	390	+0.3	0.4	1	B	B	..	..	..	..	5,500	140
6	0.12	1.42	2450	2640	210	230	74	620	60	500	92	600	76	630	+0.7	0.3	2,000	B	B	..	..	..	..	7,800	65
7	0.14	1.51	530	380	190	190	15	110	15	110	15	110	15	110	+0.3	0.5	300,000	P	P	P	P	C	B	2,400	245
8	0.12	1.28	1230	1470	130	120	49	410	49	410	62	520	77	480	+1.7	0.8	1,000	B	B	..	..	..	..	6,700	25
9	0.13	1.28	1760	1570	250	220	44	340	48	370	62	360	51	390	0	0.6	60,000	P	P	P	P	B	B	6,700	29
10	0.14	1.26	660	720	150	380	22	160	25	180	25	180	25	180	0	0.7	> 1,400,000	P	P	P	P	P	P	6,500	68
11	0.13	1.26	910	1740	60	10	58	450	44	340	62	480	47	360	+1.2	0.7	20,000	P	P	B	B	B	B	4,400	101
12	0.14	1.17	2680	2640	260	230	69	490	66	470	70	500	76	540	0	0.1	.....	P	P	C	B	..	..	10,700	7
13	0.13	1.26	2010	1660	130	140	55	420	53	410	66	510	58	450	+0.4	1.0	30,000	B	B	..	..	..	..	11,700	20
14	0.13	1.23	2120	2040	290	310	47	360	48	370	52	400	53	410	+0.8	4.0	1,000,000	P	C	P	B	B	B	13,800	8
15	0.13	1.17	2240	2220	320	430	47	360	49	380	47	360	48	370	+0.4	3.0	>1,400,000	P	P	P	P	P	C	11,400	15
16	0.13	1.28	1660	1260	180	180	42	320	51	390	47	360	47	360	+0.4	1.5	15,000	C	B	B	..	..	..	8,900	34
17	0.11	1.37	1210	1140	310	300	27	240	27	240	27	240	30	270	0	3.0	1,000,000	P	P	P	P	P	B	9,400	25
18	0.17	1.33	I	I	I	I	99	580	82	480	102	600	92	540	+0.3	0.3	.....	C	B	B	..	..	..	8,000	I
19	0.16	1.32	I	I	I	I	88	550	75	470	85	530	85	530	−0.3	0.3	.....	P	P	C	B	..	..	7,400	I
20	0.16	1.31	I	I	I	I	66	410	66	410	70	440	72	450	0	0.1	.....	P	P	B	B	..	..	9,400	I
21	0.12	1.19	1900	1570	340	450	26	220	29	240	30	250	32	270	+0.4	0.4	>1,200,000	P	P	P	P	P	P	11,400	8
22	0.12	1.19	2380	1910	370	380	41	340	41	340	41	340	43	360	0	0.3	>1,300,000	P	P	P	P	P	P	11,100	3
23[d]	0.25	0.98	4240	3420	20	20	190	760	202	810	228	910	232	930	+6.5	0.6	.....	P	P	C	P	P	P	2,600	319

[a] I = not determined because of lack of material.
[b] There was no separation of the plies in this test.
[c] P = passed, flexible; C = cracked but not broken through; B = broken.
[d] Shoe sole leather, included for purposes of comparison.



1

2

PHOTOS, COURTESY TENNESSEE EASTMAN CORP.

1 and 2—Gel dipping lacquers provide an inexpensive protective coating for such varied items as handles for kitchen utensils (above) and tips of screw drivers used in high voltage work (left)

Dip coating with gel lacquers

IS your problem the coating of long bars, handles of kitchen utensils and tools, paper picnic plates or a hundred other similar pieces?

It is possible that the articles in question do not justify the use of the expensive dies which would be needed were the cores to be covered by injection molding. Or the shape and character of the pieces may be such that spraying would entail substantial solvent loss. If such is the case the solution may lie in the use of cellulose acetate butyrate gel dipping lacquers for these articles.

These lacquers, which are made by dissolving cellulose acetate butyrate granules and pellets in suitable solvents, produce hard, thick, tough protective coatings varying in thickness from 0.005 to 0.010 inch. Greater thickness of coating is obtained by increasing the solution viscosity or by repeated dipping. The lacquers are available in any color and any degree of opacity. Suitable as a covering for articles molded of cellulose acetate butyrate as well as those molded from certain other types of plastics, they can also be used to coat metal and wood.

An interesting example of the use to which these lacquers are being put are the screw drivers shown in Fig. 2. Lest a worker carelessly touch the blade while at work on high-voltage equipment and thereby suffer severe burns, the shanks of these tools must be covered with insulation. By dipping the blades in gel lacquer of varying viscosities or by repeated dipping, the thickness of the coating can be regulated in accordance with the amount of electrical resistance called for by any particular application. The two screw drivers shown at the top and the bottom in Fig. 2 were tested at Armour Technical Laboratories and found to stand up to 7000 volts. The tools were not tested for the extreme limit of their endurance, but it is possible that they would have gone to 10,000 volts. How much thicker the covering can be made on a tool is illustrated in the screw driver which is shown at the center in Fig. 2.

Handles for kitchen utensils and tools (Fig. 1), towel bars and similar parts are particularly good applications for this cellulose acetate butyrate gel lacquer. Mechanical adherence to the core, whether it be wood or plastic, is obtained by shrinkage of the lacquer around the article during the drying operation. And long bars which are beyond the capacity of an injection machine can be coated satisfactorily with this material. The gel lacquer can also be used to make self-shrinking caps, capes and bands. In fact, the field for this coating is just beginning to be tapped.

Gel lacquer solutions are prepared at elevated temperatures and, while hot, are viscous fluid solutions. When allowed to cool at room temperature they set to non-fluid gels. Surface coatings applied from such hot lacquers set rapidly as they are withdrawn from the solution due to cooling and partial loss of solvent. They rapidly become non-tacky and, within 10 min. after dipping, are sufficiently hardened so that ordinary handling will not mar them. At the same time the parts can be dipped again if a heavier coating is desired. Ultimate hardness is secured by further complete evaporation of solvent and varies according to the formula that is used for individual applications.

In preparing the lacquer solution, the cellulose acetate butyrate granules are mixed with a suitable solvent until they are completely dissolved. Then the mixture is allowed to stand at 140 to 150° F. until all bubbles (*Please turn to page 190*)

Proposed designs for wire recorders

by W. C. NICHOLS and JOSEPH PALMA, JR.*

THE field of sound reproduction has always been one in which plastics have had extensive and varied application. That this state of affairs will continue to exist—will, in fact, be exaggerated—when industry is once again wholly absorbed in peacetime production is indicated by the extensive use which has been made of various plastics materials in a number of projected applications of a new magnetic sound recorder.

Ever since Thomas Edison scratched out the first sound recording on a wax cylinder, scientists have been searching for new methods of capturing sound for reproduction. Recently, Armour Research Foundation of Illinois Institute of Technology introduced a new—and what many electronics authorities say is a most revolutionary—development in this field. Known as the Armour magnetic wire sound recorder and reproducer, this equipment records sound magnetically on a spool of wire nearly as fine as a human hair. Then, as soon as the wire has been rewound, the recording can be played back with high fidelity.

This development offers a number of advantages, among which are:

1. Permanence of recording.
2. Low noise level and no needle scratch.
3. No break in continuity due to changing records.
4. Possibility of deleting or altering any portion of a recording without danger to adjacent portions.
5. Resistance to extremes of temperature.
6. No adverse effects on performance because of vibration, motion or position of the unit.
7. Unlimited re-use of wire due to the fact that sound can be removed from the wire by demagnetization.
8. Instantaneous play-back without processing.
9. Longer recording time.
10. No special skill required for operation.
11. Light weight and compactness, which makes it possible for a unit to be carried about with ease.

The magnetic wire recorder has been used with great success in war service and current production is going exclusively to the Armed Forces. Through the use of these instruments verbal instructions and observations of the Army and Navy which cannot be entrusted to radio can be recorded and dropped by pilots at their headquarters to be reproduced. All orders issued over a ship's communication system during battle can be recorded as can battle incidents.

Already the unit has been tried in a number of non-military applications which hint at a wide and varied field of use for these recorders in the postwar period. For example, "somewhere in the South Pacific" Marines used the recorder to send Valentine greetings to wives and friends. These recordings were then flown to the United States and distributed to local radio stations by the division of public relations, USMC. The United Nations Relief and Rehabilitation Administration is using a loaned machine to disseminate mass instructions with respect to health, hygiene, etc., in camps sheltering more than 35,000 Yugoslav and Greek refugees. Then there is the work the Library of Congress is doing in exploring the possibilities of recording on wire its collection of disk records of American folklore music. *(Please turn to next page)*

* Product Designers.

The association of W. C. Nichols and Joseph Palma, Jr., dates back beyond their present activities as managing director and design director, respectively, of Product Designers. Previously they had collaborated in the firm of Nichols & Palma, industrial design associates.

Singly and together Mr. Nichols and Mr. Palma, Jr., have served a long list of leading industrial accounts. Their activities have included design work for companies engaged in the manufacture of motor cars, pianos, engines, transformers and comptometers. In addition, Mr. Palma received national recognition for his exhibits for the Chicago Century of Progress and for his designs for a large mail order house.

Today, the organization with which they are associated offers a complete product designing service including idea development, design, engineering and packaging. There is also a newly inaugurated architectural design division. All these services were called into play in the development of the six proposed designs for wire recorders. First there was the need for envisioning the possible uses for such a unit. Then came a study of the market. As can be seen, the wire recording units pictured on the following pages are intended to meet every need—commercial or civilian.

With such an extensive background in the development of new products, it was but natural that Mr. Nichols and Mr. Palma should appreciate the possibilities of plastics as applied to both structural and decorative parts. Their suggestions are an indication of the varied roles these materials will play in postwar products.

JOSEPH PALMA, JR.

W. C. NICHOLS

2—*Compactness and sturdiness are combined in this proposed design for a pocket wire recorder. Side panels might be molded of phenolic, controls and microphone of phenolic or urea*

1—*Plastics suggest themselves for the case, panel, knobs of this portable wire recorder*

ALL RENDERINGS, COURTESY PRODUCT DESIGNERS

As for tomorrow, the recorder should find wide application in the fields of industry, commerce, education and entertainment, and in the home. Projected uses include the incorporation of a wire recorder in home and field radio receiving sets as well in radio-phonograph combinations or automatic phonographs where it could record and play professional records. It might also be used to advantage in speech training, language and music courses, commercial and vocational training for a variety of training purposes in schools, colleges, institutions and industries. Recorders for office and remote dictation, for police calls and reports, for court reporting and for transportation communication be it on the land, on the sea or in the air, are a few of the more obvious postwar applications to which this development might well be put. Or the units might be employed in broadcasting and for remote pickup, for the transmission of church and industrial music, for the production of sound for slide pictures or motion pictures. The licensing of manufacturers in these fields is under the control of the wire recorder development corporation.

So that manufacturers and consumers, both commercial and civilian, can judge the possibilities of the wire recorder, our organization has suggested a number of postwar uses.

A compact console unit such as that in Fig. 3, which combines radio reception, recording, play-back and television, should be a good application for the home market, supplanting prewar radio-phonographs with their cumbersome record

3—*In the home, prewar radio-phonographs may be supplanted by a compact unit such as this which combines radio reception, recording, play-back and television. Possible plastic applications are a plywood housing, sliding doors of acetate rods and molded knobs*

4—The case of this projected portable dictating wire recorder, which is intended either for dictation or play-back, might be molded of phenolic or melamine resins

changers. As designed, the cabinet housing is well adapted to the use of plywood. Access to the operating panel is through sliding tambour doors located in the top of the cabinet. These doors might well be assembled from extruded acetate rods, held together with metal clips and backed with some type of cloth. Push buttons of cellulose acetate or acrylic, pulls of acrylic; knobs molded of phenolic or urea are other plastic applications.

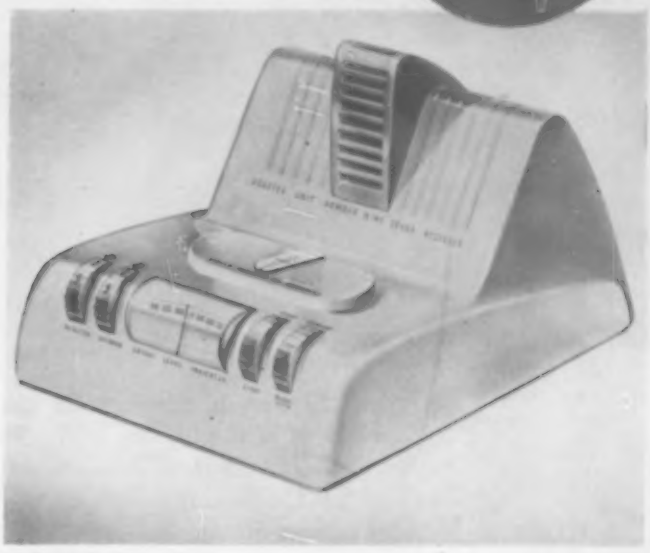
Since not all consumers will either want or be in a position to purchase complete units such as just described, the design for an adaptor unit has also been worked out. The housing of this machine, which would be attached to existing home radios for recording and play-back, could well be molded of cotton flock filled phenolic or melamine resin. Like many present-day radio control wheels the controls on this adaptor (Fig. 5) could be molded of cellulose acetate or acrylic resin.

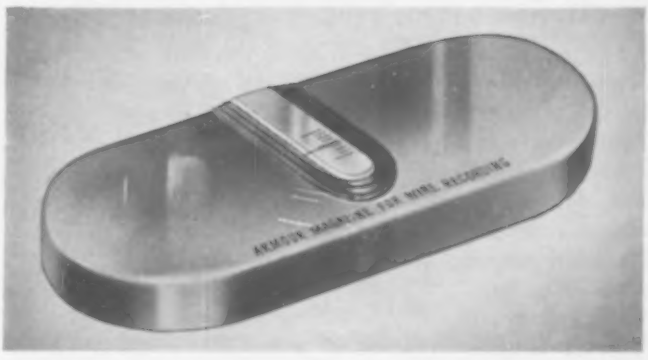
A key development is the universally adaptable wire recording blank shown in Fig. 6. The standard recording blank for all wire recorders, it is interchangeable on all home and commercial equipment and provides for an hour's recording. The body has been so designed that it can either be stamped from metal or molded of plastic. If produced of polystyrene the unit could be entirely sand-blasted except for a small slit which would be left untouched so that the wire remaining on the wheel could be checked. Should a phenolic or urea material be used, the slit could be covered over with a transparent plastic window.

Leaving the home for the business office, there is our projected portable dictating wire recorder—a dual purpose machine which could be used both for dictation and play-back (Fig. 4). Here, again, the design calls for the use of either cotton flock filled phenolic or melamine resins. The stop, start and play-back controls are an integral part of the recessed section which houses the microphone. Provision is made at the back of the portable unit for the rewinding of a used blank while a recording is being made on another wire.

A possible design for a battery-operated pocket model of the wire recorder is pictured in Fig. 2. The microphone is

5—Not all consumers will be able to purchase complete wire recording units such as shown in Fig. 3. For these people an adaptor unit has been worked out whose housing might be molded of phenolic or melamine





6—Either polystyrene, phenolic or melamine resin could be used for the case of this universally adaptable wire recording blank. This unit is interchangeable on all types of equipment and provides for an hour's recording

housed behind a sliding panel in the top and it can be extended for the convenience of the user. The carrying handle is retractable. Possible plastic applications are molded phenolic side panels and molded phenolic or urea controls and microphone.

The design shown in Fig. 1 is our suggestion for a portable, battery-operated wire recorder and play-back in which provision has been made for radio reception. A low-pressure laminate might well be used for the case of this unit, a high-pressure laminate for the front panel, phenolic for the control knobs, metal for the grill and ethyl cellulose for the carrying handle. This combination, designed for either home or commercial use, is provided with a dual blank attachment so that one roll of wire can be rewound while a second is in use.

These proposed designs suggest but a few of the many possible postwar applications for this wire recorder. However, they indicate that this development may be of twofold benefit to the plastics industry—as an application which it can use as well as one which it can make.

N. O. BRODERSON

New president of S.P.I.

Neil O. Broderson, president of the Rochester Button Co., has been elected president of the Society of the Plastics Industry, Inc. He succeeds George K. Scribner, president of Boonton Molding Co., who becomes chairman of the board of S.P.I. following a 2-year term in the office of president.

Other officers elected by the association for the ensuing year were: George H. Clark, Formica Insulation Co., as vice-president, and Warren E. Hill, Prolon Plastics Div., Pro-phy-lac-tic Brush Co., as secretary-treasurer. The new directors are John J. Bachner, Chicago Molded Products Corp.; Charles F. Elmes, Elmes Engineering Works of America Steel Foundries; Charles H. Frantz, Kurz-Kasch, Inc.; Herman B. Lermer, Celluplastic Corp.; W. H. Milton, Jr., General Electric Co.; Gordon Brown, Bakelite Corp.; Lloyd Falkenhagen, Jos. Stokes Rubber Co.; Donald L. Gibb, Dow Chemical Co.; and Frank Wilcox, Wilcox Plastic Moulding Co. Reelected to the board were Paul G. Tietz, The Richardson Co.; and W. J. McCortney, Chrysler Corp.

The new president's—Mr. Broderson's—connection with the plastics industry dates back to 1919 when he received his honorable discharge from the U. S. Navy. At that time he became associated with his father in the button manufacturing business as treasurer of the Superior Ivory Button Co.

In the next few years, Mr. Broderson and his father organized the Accolite Manufacturing Co. and then the Alladnite Co. Then, in 1926, the Superior Ivory Button Co. was consolidated with the old Rochester Button Co. and the Shantz Button Corp. to form the new Rochester Button Co. At that time, Mr. Broderson became general manager of what was formerly the Superior Ivory Button Company's plants and secretary of the new corporation. Two years later he was elected president of the present Rochester Button Co.

As president of the company, Mr. Broderson was in large part responsible for the establishment in 1935 of a pilot plant for the manufacture of molded plastic buttons. A similar plant devoted exclusively to the production of casein buttons was constructed in 1934. This research and development work was expanded through the years until, in 1944, the Rochester Button Co. discontinued the manufacture of vegetable ivory buttons so as to devote all its facilities to the production and sale of plastic buttons.

During the last few years, between 1937 and 1944 to be exact, Mr. Broderson was associated with the Samson United Corp., first as a director, and later as the chairman of the board.

In accepting the nomination, Mr. Broderson said: "Reconversion to the production of consumer goods in the plastics industry will be comparatively rapid as soon as materials have been made available. The industry realizes that it will be faced with the problem of maintaining production and employment at the extremely high levels achieved during the war. It is hopeful of realizing this goal."

PRESS ASSOCIATION, INC.

A report from the Pacific

by ROBERT L. VAN BOSKIRK

Mr. Van Boskirk has recently returned from a month's tour of Navy bases in the Pacific. His observations are devoted almost exclusively to Navy applications but space limitations and censorship regulations prevent an item by item report on plastics performance

A battleship in war time is something more than awe-inspiring. It is impossible to explain the feeling that wells up inside a man when he first sights one of these magnificent fighting engines.

And the nerve system of this fighter is encased in plastic. Up and down, across and around, in almost every nook and corner, these ships are laced with miles of cable. When I visited one of these ships an officer removed a small section of the deck flooring. In the one compartment thus disclosed there were numerous bundles of cable secured together in groups about a foot in diameter. This one little compartment probably contained more cable and more varieties of cable than are generally found in the sizable underground communications conduits that lie beneath big city streets.

Depending upon the particular battleship described, from 850,000 to more than 1,000,000 ft. of insulated wire make up that network. When the ship goes into action this nerve system responds to orders from the brain (the commanding officer) of the ship in almost the same way that a human body reacts to the command of its brain cells. The impulses of the leaders are carried to and executed by guns and gunners who may be in remote parts of the ship. So perfect is this mechanical nerve system that it practically gives a ship the senses of sight, hearing and touch.

In large part, this nervous system's capacity to perform in such a sensational manner is due to the wedding of electronics with plastics. Most engineers will agree that without plastics' dielectric qualities some of today's electronic miracles would be impossible. Further, they predict that some of the things learned from electronics operation in war time, when applied to civilian applications, will create as much or more enthusiasm in the public mind than radio did after the completion of World War I.

The principal plastics used in Navy cable are the vinyls and polyethylene. A great portion of this cable is armored—covered with thin braided metal. Sometimes there are two layers of armor with insulation between. Aluminum, copper and even silver have been used. Vinyl resin has generally replaced rubber as insulation material in these applications, particularly in coaxial cable. In fact, the Navy was ahead of private industry in appreciating the value of vinyl resin for wire insulation and began experimenting with it in 1935. The use of this material helped to eliminate the need for heavy brass conduits.

Not much can be told about the use of polyethylene in cable. It is comparatively new in the U. S. Navy although the British experimented with and knew of its excellent dielectric qualities at the beginning of the war. Although polyethylene will melt when held in a match flame, electronic waves of the greatest intensity will not faze it. Consequently, a comparatively thin layer may be used as insulation. But this layer is generally protected with a vinyl jacket. Its extensive use for insulation on high-frequency and high-voltage wires after its release from its wartime duties is a foregone conclusion.

There are other plastics of vital importance in this electrical menage. Polystyrene is performing almost unbelievable feats in insulator equipment, and we hope that the Navy will release information on at least a few of those accomplishments before too long. When molders learn of polystyrene's usefulness against the Japs, they will be much less likely to wonder why they can't have it for civilian purposes.

The old standbys, phenolic and phenolic laminates for fixtures and control boards, are always in evidence. There were reports of the breakage of a few phenolic fixtures due to vibration when the heavy guns are roaring. However, nearly everything else on shipboard is subject to destruction at such

times and it would seem that little attention need be paid to complaints such as these.

When asked about melamine and glass panels for control boards, one officer expressed surprise. Said he had never heard of them—had very little trouble with "tracking" in his experience. Later at Pearl Harbor it was explained that the new type panel boards had been discussed, but none were on hand. Possibly only new ships are thus equipped. Perhaps I failed to contact the right informant. The Navy is a big organization and there is a considerable lag between development of a new product and the time when it is finally put into actual service.

Plastics fill the bill

But I did encounter many applications that made me proud of plastics. For example, I examined the bedding covers on the various bunks that were scattered all over the ship—in the cooler, behind control boards, down in the bowels of the ship, everywhere. A supply officer was with me. "Aren't these vinyl coated?" I asked. "No!" he replied, "Rubber." I smelled, rubbed, pulled and scratched the covers. Finally, I approached another officer, who said, "Sure, they're plastic coated—supposed to be fireproof. And we're mighty happy to have as much flame-resistant stuff on here as possible.

"And here's another plastic for you. Look at this flashlight—it's really waterproof. They tell me those desalinators for life rafts are great stuff, too, but here all we've got are those kegs of water which you see in the raft. We've also got a lot of little stuff around here—look at that furniture hardware and the bathroom fixtures. We also have quite a few plastic dishes such as these bowls and trays, although I notice that all our partitional trays are metal. And look at that heavy furniture in the ward room—it's far too bulky. I understand that the newer ships are getting furniture that is partly plastic, at least the upholstery is plastic. How about putting in a word for us when you get back to Washington?

"And I suppose you know about the plastic paint we are using on bottoms now. It keeps barnacles off so that we don't have to come in to dock for scraping. Ships treated with this paint have stayed out 27 or 28 months without scraping. The former practice was to scrape off the barnacles every 9 or 10 months. The plastic acts as the vehicle for the poison that destroys barnacles and provides the adhesive properties, but the formula is locked up in Navy files. There are several types for both large vessels and small wooden boats. It is applied hot when facilities are available.

"But friend, you just can't write about the most important plastic uses in the Navy. We figure the Japs don't know and we are not going to tell them."

Secrecy, a civilian handicap

It is unfortunate that many of these life-saving and death-dealing items cannot be revealed at least to the extent of a brief announcement of what the parts are doing and what plastics they contain. If their effectiveness could be told it is just possible that WPB would have much less trouble shaking off demands for civilian goods made from the same plastics that the Navy wants for war. Many persons still feel that the war is more than half over and therefore military demands should only be half of what they were when we were fighting two wars. This reasoning simply cannot be applied to plastics because more and more synthetic resins and the chemicals necessary to their compounding are being used for these special devices. Some resins may not be as necessary as others for war. But at the present rate of development it is not at all unlikely that some inventor will find a new use for the more plentiful types such as phenolic or acetate which will absorb a great slice of total production.

Limitation on plastic applications

One of the most startling impressions an observer gets when hunting for plastics in those vast Pacific areas is their small quantity in comparison to other items. Take screen cloth as an example. It has been proved that nylon or vinylidene chloride screens will outwear metal in the tropics. But there is nowhere near enough to fill demands. On Kwajelein we saw nylon screen that had been in place since last November and was still in good condition. Informants told us that ordinary metal wears out in a few weeks even though coated with oil each week. Copper resists the climate but corrodes and fills up. There was considerable acetate with scrim or wire backing used for small windows in the ends of Quonsett huts and hospitals and apparently it was entirely satisfactory for these uses.

Life on a Navy land base is different from what it is on shipboard even though the men insist that a floor is a deck and a wall is a bulkhead. In such places plastics are seen in about the same proportion as in civilian life and receive the same praise or condemnation. It was in such places that I saw hundreds of the much-talked-about coat hooks. Apparently they were giving good service and certainly made a neat appearance. Admiral Nimitz' headquarters were well supplied with them. Plastic shower heads, too, were in abundance wherever there were barrack buildings. There must have been millions of Scripto pencils with plastic barrels and new calendar pads were just arriving, although these latter were meeting with some mild criticism because they were designed so as to have grooves for pens and pencils at the sides which were too short or permitted the pencil to slide out. Soap boxes, combs, razors and razor boxes and similar items were in abundant quantities with little or no comment from users about their qualities.

Interest in plastics

During our stay at Guam, I had occasion to visit a medical dispensary. When the sailors learned that a plastics magazine correspondent was there, several called upon me. The pharmacist's mate in the ward I visited was one Eddie Healey, who promptly informed me that he was from the "plastics capital of the United States—Attleboro, Mass." If that dispensary was a fair sample, the Navy has done a great job of picking its hospital corpsmen. Every one in that unit was a wholesome, intelligent, conscientious man. I am sorry that my subject doesn't permit more detailed description of each one whom I met.

But it was through this connection that I learned about servicemen's great interest in plastics. It was quite different from that of the officers who were working with plastics items. The latter seemed to take plastics as a matter of fact. If Washington decided they were to have plastics they used it as the tool considered best for the purpose. It was just another material. If it worked—fine. If not, they wrote a failure report about it or simply discarded it when something else was available.

But the enlisted men have picked up the glamour often without even recognizing that such commonplace items as telephone sets are molded of plastic. Almost without fail these men want to know what raw materials are used. A fair proportion seem to think that soy beans are the principal source. Any number will ask about plastic autos and plastic

houses. They have as yet no idea of the more important war uses to which plastics have been applied.

Many enlisted men of all the services are studying the Government's printed lessons on plastics. It was my understanding that the lessons were particularly popular among the Seabees, who are rapidly attaining prestige equal to the Marines. In their workshops they fashion all sorts of things out of methacrylate scrap. Like all other servicemen, one of their first questions is, "What about jobs after the war?" Many of them hope that the plastics industry will help solve their personal job problem.

It was from the Marines that I learned about the quantity of plastic fragments which speckled the ground at Iwo. Presumably they came from mortar and rocket ammunition. From other conversations I learned that the Japs apparently know more about plastics than was deemed possible from what we knew of their experience before the war. It was presumed that their knowledge was confined largely to nitrate and phenolics. It may be that those are still their standbys, but it is possible that they could have learned more from the Germans. And their rather extensive development of electrical projects may have given them a number of ideas about the usefulness of plastics.

The Marines themselves confessed to little knowledge of plastics. The famous camouflaged poncho was much in evidence, but they didn't know there was any plastic involved. They claimed it was very satisfactory but became stiff after long usage. "How long?" I asked. "Oh, about two years, maybe." Two years seemed a long time to me for that kind of wear. They also complained about plastic canteen stoppers which broke up on easy provocation. They were not conscious of the M-52 fuze in mortar shells. In addition, they were strangers to plastic scabbards and machete sheaths—those that I saw were the older types. Special inquiry was made concerning plastic automatic rifle stocks, but none had ever been issued to them. They had ordered 50 of the new type plastic-coated portable water tanks, but had received plain canvas ones instead and were told that the old stock must be used up first.

It was perhaps not surprising that plastics should be comparatively unknown to the rank and file of the Marines, but it was a shock to find that aviators in a B-29 group were not more plastics-minded. To them plastic is the transparent acrylic used in noses and blisters.

Plastics in the B-29

Although a B-29 appears immense when seen from the ground, the plane has little more than enough room for the crew. The space is largely taken up by instrument boards for the various controls needed to conduct long-range flying and fighting and by the long tunnel in the fuselage, which incidentally is cycle-welded. There are hundreds of pounds of plastics within this flying behemoth. For example, there must be well over 500 small laminated pulley wheels and many feet of laminated tubing or conduit. The 12,000 or more feet of cable calls for great quantities of vinyl insulation and tubing of various sorts built from phenolic laminated material, vinyls, neoprene and rubber. For the most part, panel boards are metal and gage cases are back in glass after plastics were discarded because of discoloration. Floor boards and glass-laminated fuel cell separators which give support and also prevent flowering of gas tanks must be added to the list of plastic parts on a B-29. There was some complaint about the cracking of nitrate dope used on the fabric portion of the wings but that is an old story which has been subject to investigation and a search for improvement over a long period. The Navy is using butyrate for this purpose and has reported satisfactory results.

The Navy also reports a method for mending cracked methacrylate which is now practiced at the Oakland Navy Air Base. A nichrome wire with electrodes, inserted in the crack, fuses the sheet together as the wire is moved through the course of the crack much like a scroll saw through wood. The method is reported as still experimental. It is said to be satisfactory so far as optical results are concerned, but not completely successful from a strength standpoint.

Almost nothing has been mentioned of Pearl Harbor in this report and yet in some respects that is where the most sensational things are happening. There you see great ships, torn and wounded, being repaired to steam boldly back to conflict. There it is commonplace for a ship with a smashed bow to come in and get a new one welded on just as though it had been ordered from a mail-order house and delivered at the dock. The bow is made in advance and is ready for application as soon as the ship comes in. Another interesting surgical operation on a ship is the process of cutting a tank landing craft in two and adding a piece in the middle so that it will be able to handle the new and larger Pershing tanks.

Navy molding shop

The chief civilian assistant to Commander Barnes, superintendent of the Navy Shops, was R. W. Miller, an enthusiast for plastics, who predicts that they will soon have the electrical field entirely to themselves. He was disturbed because he had been unable to secure an injection machine, although he needs from 10,000 to 15,000 small plastic parts a month and has the molds to make them. At present his helpers are molding polystyrene parts on an old hand-made compression press.

Principal attraction in the molding shop is Joe Butterfield, whose twinkling eyes look up over his specs with one of the most mischievous expressions imaginable as he drawls, "Well, you know, I was too dumb to know it couldn't be done, so I done it." Joe is one of those miracle men found in some machine shops who can make anything out of nothing.

Another ingenious worker at the Navy Yard Repair Unit is Edwin J. Bower, chief electrician, who with his assistants devised a new way for placing calibrations on plastic instruments. It is not printing, etching or engraving. He calls it tattooing. With his method an image can be reproduced in a variety of colors and at various depths on any solvable plastic. The process has interesting possibilities and has been patented. Full details of this process will be given in an early issue of MODERN PLASTICS.

Before closing, may we make the following suggestions to fathers of sons in the Pacific who are readers of this magazine?

1. Write more often, but send news with your letters. Any letter is welcome, but sailors and soldiers want to know about things at home. Who is sick—where is Jim Smith—how about that new postoffice? News! News! They crave it. They like newspapers but they are always old when received. One mother pleased her son by sending newspaper clippings in her letters.

2. Most acceptable gifts seem to be snacks. Service food has a terrific sameness. If you can, send such things as cheese, canned lobster or crab meat.

3. There is a terrific yen to get home among all classes of servicemen. Some of them have been out in that area for over three years without relief or furlough. The sameness together with the heat and sultriness in some locations is maddening. Remember this during the reconversion period ahead—don't let those men down.

COLOR PLATE AND PHOTOS, COURTESY BAUSCH & LOMB OPTICAL CO.

Anatomical study of the eye has been much advanced by the publication of this book in which 34 paintings, each representing a layer of the human eye, are reproduced in 5 colors on thin sheets of cellulose acetate

Mapping the eye on transparent film

SEEING is believing—a phrase that once was all too glibly uttered and all too difficult of accomplishment particularly in the fields of science and medicine. But today, through the medium of transparent cellulose acetate film, the seeing can be done within the confines of the home, or in the library, as well as in the laboratory or dissecting room. An excellent example of how this can be accomplished is the book, "The Human Eye in Anatomical Transparencies," published by the Bausch & Lomb Optical Co. as a service to the professions using the company's instruments for eye examinations and refractions.

The function of all medical exposition is to provide the clearest possible mental impression, particularly when the subject is an anatomic one. Words alone cannot accomplish this ideal, but words supported by adequate illustrations can. In this case the illustrations are 34 unique stereographic paintings of a right eye, twice normal adult size, executed by the artist, Gladys McHugh. Made from serial dissections of an eye in its primary position and its orbit, in the frontal and temporal aspects, the water colors were executed in natural colors which were augmented by the conventional diagrammatic aids of depicting the veins as blue and the nerves yellow, to differentiate them from the arteries which appear in red.

From the readers' point of view

The paintings are printed on double sheets of cellulose acetate in 5-color rotogravure,[1] and the sheets are so

[1] Trans-vision process of the Milprint Corp.

arranged that they fit over each other perfectly to present all serial layers in their proper order. Thus the reader can start with a representation of the outer conjunctival surface of the eye and, by simply turning the pages, expose views of succeeding layers of tissue until finally the orbital bones are reached. The reverse sides of the various strata of the eye appear on the left-hand pages, accurately superimposed upon the views on the respective preceding right-hand pages. This arrangement not only makes possible a study of both aspects of a given stratum but the dissection of the eye from its anterior to its posterior surfaces.

The use of transparent pages offers a number of advantages. One of the most important stems from the fact that any part of the eye is easily isolated for detailed study. In sections of a given layer where no anatomic details appear—in the opening between the lids as seen at the left-hand page in Fig. 1—a glance at the cellulose acetate sheet permits instant visualization of the underlying structures which show through from the succeeding or preceding page, whichever it may be.

In the case of small depicted sections another advantage of the transparent sheets is that they make possible the observation of the supporting mechanisms before and after the sheets upon which the sections appear are lifted. Hence, for example, the relation of the posterior half of the eyeball wall to the apex of the muscle cone is clearly evident.

How the printer looks at it

Behind all these advantages lie long months of painstaking labor. Once the decision was made as to the number of illustrations that would appear on these acetate sheets, the artist had to prepare her work. Exacting draftsmanship was required since anatomical details had to register when they were reproduced on the transparent pages. The job was run on a rotary press using rolls of acetate film 17½ in. wide. In this rotogravure process the ink is applied to the back side of the sheet so that the reader is actually looking through the transparent material when he views the finished illustrations. This gives the pictures added brilliance and eliminates any possibility of their being scratched or harmed.

Binding it all together

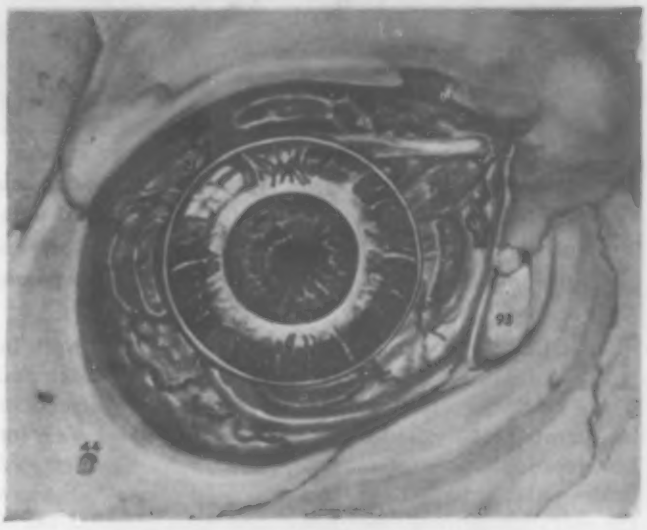
When the rotogravure work was completed, the cellulose acetate sheets were cut and rough folded. This mechanical fold was made very lightly inasmuch as every sheet had to be registered by hand and then permanently folded. After all the pages had been placed one upon the other and registered, they were fastened with two wire staples at the binding edge and trimmed at the bottom to give a uniform edge. Following this operation the lithographed back-up sheets which register with each of the pictures printed on the transparent pages were properly located.

When this unit was delivered to the binder for assembly with the balance of the book, new problems arose. Various types of binding were tested and discarded. Finally it was found desirable to stitch the acetate sheets approximately ¼ in. from the binding margin. This prevented the pages from bulging and kept the unit in register. Only after this was done were the transparencies bound in.

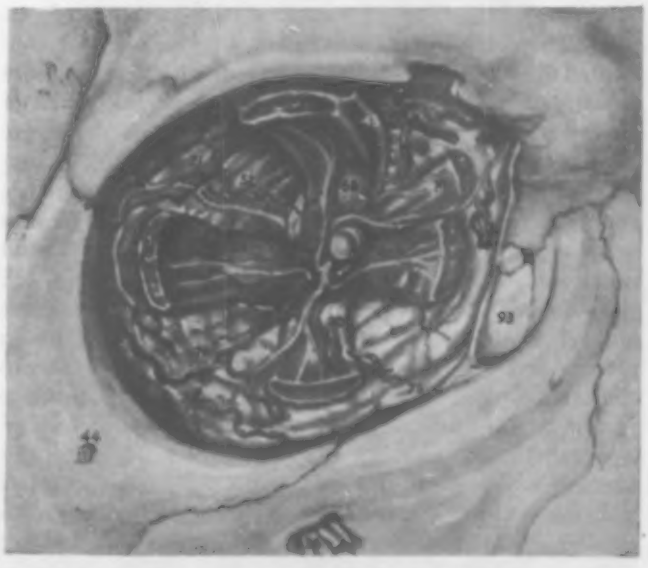
It is not difficult to understand why this volume has such unusual appeal. As the printed pages are turned, the reader is impressed by the novel method of pictorial presentation and the unusual anatomical detail shown in the natural color paintings.

Credits—Material: Lumarith. Book by Bausch & Lomb Optical Co.

The advantage of the acetate sheets lies in the fact that readers can study each succeeding layer of tissue



The double sheets of acetate make possible the representation of both sides of each layer of eye tissue



All 34 water-color paints are executed in natural colors augmented by conventional diagrammatic aids

Moldings for induction heating unit

ALL PHOTOS, COURTESY DUREZ PLASTICS & CHEMICALS, INC.

1

2

1—Because of the high-power, high-frequency currents used in the operation of induction heating machines, it is but natural that a plastic material with excellent electrical properties should be used in many of the machines' parts. These 3 terminal assembly parts, for example, are molded of a high-impact phenolic material. 2—These 4 core assembly pieces are molded of the same material as the parts in Fig. 1

MOLDED plastics have recently been put to work in transformers of certain induction heating machines. These machines employ high-frequency electrical currents to heat-treat (heat-harden) metal. They are designed solely for heat-treating internal diameters—round, splined or serrated holes—either straight or somewhat tapered in section. Since the operation of these machines is dependent upon the use of high-power, high-frequency currents, it is only natural that certain plastics because of their excellent electrical properties should have been considered for some of the parts.

However, when the manufacturer first investigated the possibilities of using plastics in this machine he was confronted with the problem of volume production. The plastics industry has been prone to stress volume when it comes to molded plastics applications. At times, applications where plastics fit the job best have been passed up because the number of parts required was limited. Nevertheless, there are many cases where the inherent physical properties of plastics so far outweigh higher costs due to small volume that the end result warrants the use of these materials.

No doubt this was the condition when the engineers of this induction heating company gave their first consideration to plastics several years ago. But certain parts of those machines simply had to employ plastics in some form to function properly. In consequence, a phenolic laminate was incorporated in the design of the transformer. However, this laminate required a tremendous amount of machining, a fact which added considerably to the total cost as well as to the time required for the production of the machines.

Company engineers held to the belief that the ideal solution to their problem was molded parts. Finally, about a year ago, in cooperation with the engineers of a plastics molding plant, they found a very satisfactory answer in the use of a high-impact phenolic molding material. Seven parts are now being molded of this phenolic compound for the transformer. Figure 2 shows the four parts which actually make up the core assembly of the transformer, while Fig. 1 pictures the three parts required in the terminal assembly.

Since this is a switching transformer operated by air pressure, there is as light impact as it opens and closes, particularly during the set-up period when the machine is being installed. The opening to closing range is approximately 9 inches. Because of this, a high-impact phenolic molding material was required, primarily as a safety factor, since this movement has to be set to the individual machine.

Four molded parts in core assembly

The molded parts of the core (Fig. 2) consist of the cylindrical center, two end pieces and a laminating wedge. The center section is nearly 8 in. high and has an outside diameter of $6^{3}/_{8}$ in. and an inside diameter of $3^{1}/_{4}$ inches. This one piece, weighing about 7 lb., is one of those really tough jobs custom molders come up against now and then. Its successful production is indeed a credit to those engineers who made it a practicality. Seven flutes about $^{1}/_{2}$ in. deep are spaced around this cylindrical center section and hold the assembly locking rods in position. These flutes extend slightly beyond the normal ends to serve as locating shoulders for assembling the top and bottom parts. Both the top and bottom sections have corresponding locating holes, molded in. The countersink is also molded in, to assure positive faster assembly. The top piece is literally a shouldered flange, the very top rim having an inside and outside taper. It weighs almost a pound.

High-frequency preheating was eventually employed in the

molding of the center section (primary core). Not only did this reduce the normal cure time by 15 min., but it also made possible improved cut-off with closer dimensional stability on the closed height. This center section was the most difficult of all the pieces to mold. A tolerance of 0.010 in. on 7-in. dimensions was all that was allowed. Because of the size of the piece and the volume of high-impact molding material required, the fact that this tolerance, which is vital to the functioning of the piece, was held is indeed worthy of note. This was partly maintained by the preconditioning of the material. Incidentally, all parts were made in single-unit molds and produced on a 350-ton compression press.

The bottom section (Fig. 2) is another interesting molding job. This part has a very irregular-shaped well, the bottom of which not only has several radii but is also of varying depths. This well holds a connecting elbow for one of the terminal connections. The machining of this section from a solid block, the original production method, involved considerable milling. In the original part only the small well was machined; the balance of the base was a solid section. In molding, however, the design engineers eliminated this excess material and thereby reduced the weight of the piece. This material elimination also helped slightly to compensate for shrinkage of the molded part. Now the part comes from the mold ready for assembly. No machining is required beyond the removal of flash or fins. Ready for use, the part weighs nearly two pounds. It is a little more than $2^1/_2$ in. high, and the well-section wall extends about half the height.

The laminating wedge, which serves as an insulation block spacer between laminations, provides another excellent example of the advantages of molding over machining—since the required tolerances have an allowable variation of ±0.003 inch. Cutting the piece from a solid bar involved considerable milling at an angle and machining of a radius for the full length of the top of the piece and on the inside of each end. The holes are molded in. The small holes have an inside shoulder about $^1/_4$ in. high from the bottom of the piece. Connection between this part and the whole unit is made through the large holes at each edge of the wedge, one for the positive and one for the negative terminal. In all, more than 10 lb. of material are required for the four molded pieces which make up this transformer.

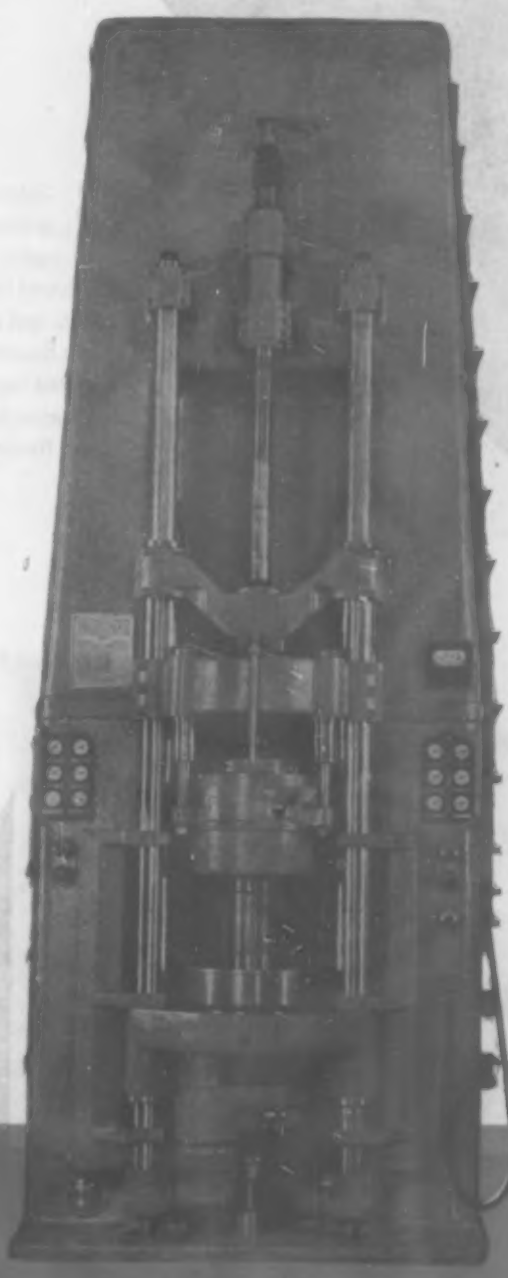
Three parts instead of six

The terminal assembly, which consists of three molded pieces, replaces an original assembly of five or six pieces. Just as in the case of the transformer core, molding these parts of a high-impact phenolic material resulted in great savings in time and costly machining. Until recently they were machined from solid blocks of another self-insulating material, and two parts which are now incorporated integrally in the finished piece were machined and assembled separately. The smaller pieces serve as terminal connection insulators. Since the high-frequency connections enter the transformer through this terminal block assembly, the inherent self-insulation property of the phenolic material proved of value.

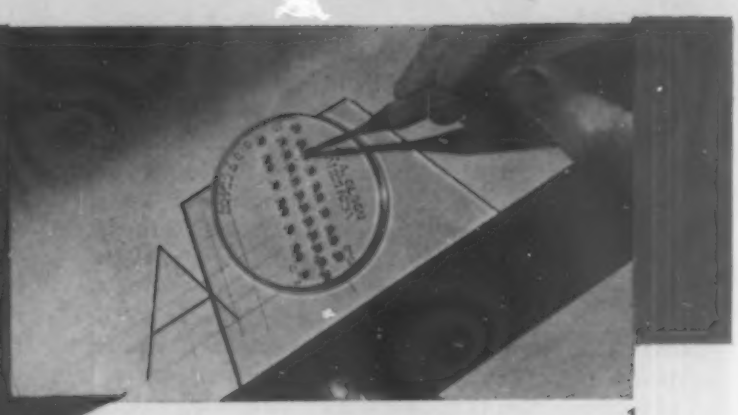
The result of molding these 7 parts of plastic has really been threefold: first, costs have been reduced; second, assembly has been facilitated; third, performance has improved since the adoption of the molded parts. The molded parts have a much lower moisture absorption property than the material originally used. Consequently, there is less expansion and contraction of the parts during a drying out period.

The major point of interest is the cost reduction, which warrants a brief explanation. On the basis of the small number of pieces to be produced from each mold, the mold costs were proportionately very high. However, even in the face of this fact, a 15 to 20 percent over-all saving has been achieved over the method originally used. Actual figures show that the total combined cost of all the finished molded pieces was only 10 percent of the original mold cost. This proves that volume production is not always essential to lower cost in adapting molded plastics to a job, when final over-all costs are taken into close consideration.

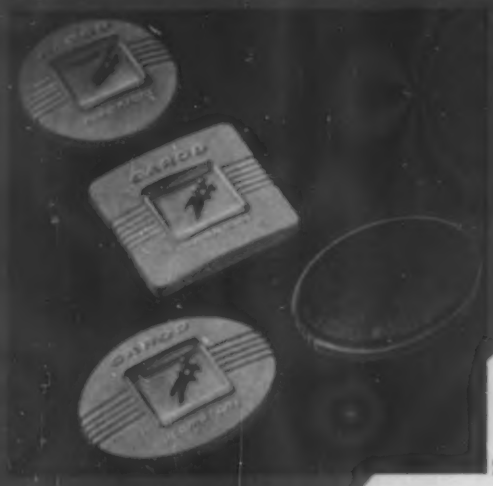
Credits—Material: Durez. Molded by Michigan Molded Plastics, Inc., for Budd Induction Heating, Inc.



3—Originally the 7 parts of this induction heating machine which seemed to require plastics in their composition for successful operation, were machined from a phenolic laminate. The switch-over to a molding compound saved much time and labor



1



2

1 To assure accuracy in lettering the O. A. Olsen Mfg. Co. offers its Ames lettering instrument, stamped from transparent sheet Lumarith. Made in two parts, the instrument has a revolving circular center piece

2 Miniature show windows for each Permatone phonograph needle, these novel cases injection molded of Tenite by Waterbury Companies, Inc., and product of Garod Radio Corp., have a Lucite window which is also the lid. Felt on the bottom of the case makes it a record brush

3

3 Submersion-proof, hence important to Marines, is a lip microphone and headset developed by Bell Telephone Labs., Inc., and manufactured by Western Electric Co., Inc. The microphone has a compression molded Bakelite housing; and the headset, Neoprene earcushions

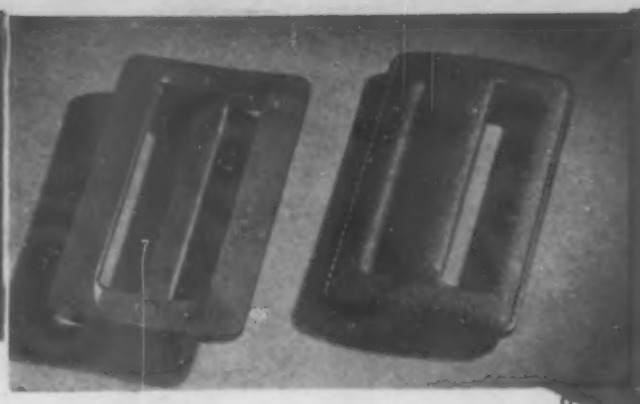
PLASTICS

4

4 Trays with compartments for tiny parts speed assembly of tubes for pocket-size radios. They are compression molded of Durez in a two-cavity semi-positive mold by Norton Laboratories for Sylvania Electric Products, Inc.

5 If a blood transfusion bottle is not sterile, a danger signal is flashed to the attendant by the color of the Sylphseal band around the top of the bottle. The bands, product of Sylvania Industrial Corp., are treated so as to turn from green to orange when they undergo sterilization

5



6 Enlisted men still keep coat belts in place by tugging but officers may wear a plastic slide buckle, said to be slip-proof at any adjustment, which is molded of olive-drab cotton flock filled Resinox by North & Judd Mfg. Co.

7 Life-like creatures of the deep are fabricated from plastic by the Illinois State Museum for its Living Museum. The marine worm is of Lucite roughly cut to size and shaped with a minimum of heat, then finished with abrasives, files and polishes

IN REVIEW

8 The city of Syracuse, N. Y., has spared itself one maintenance headache by following its neighbor, Auburn, in installing clear Lumarith windows in its parking meters. Such windows, fabricated by Bill Dewitt Shoe Form Co., are less easily smashed than those of glass

9 A spark plug adaptor—or elbow—for a Packard Rolls-Royce motor has interior insulation and a rounded nose of Melmac which fits into a tubular extension (well) of the spark plug. Northern Industrial Chemical Co. preforms the melamine, transfer molding it into the metal case

10 Moisture is kept from reaching bullets in a 45 caliber Thompson sub machine gun by means of a magazine cap of transparent Tenite II molded in an 8-cavity mold by Gemloid Corp.

Occupational Therapy

by CAPT. FRANK D. DOLAN and LT. HAROLD A. SCHULZ*

The therapeutic value of plastics lies not only in their physical reconditioning effects but also in the manual dexterity which they promote. Army psychiatrists have found that their attractive appearance and ease of handling provide stimulation beyond the simple "busy" work required in the initial exercising of injured muscles and nerves

Occupational therapy is an established part of the treatment our veterans receive at Army hospitals throughout the country. The value of plastics in this reconditioning work may be judged by the fact that a course for Plastics Technicians is now being taught to Medical Corps personnel at the Ordnance School at the Aberdeen Proving Ground. Here enlisted men and women from all kinds of Army hospitals are being trained to handle the material so that they, in turn, can instruct wounded veterans in this medium.

The Army's use of plastics began some time ago when pieces of acrylic were among scrap materials received from plane factories for occupational therapy work. These transparent plastics offer one distinct advantage over wood, a traditional material for this work. They are cleaner and cause less dust. This is extremely important in the case of patients suffering from tuberculosis or similar diseases.

There is a wide range of exercise involved in making plastic articles. At the simplest level there are the cigarette boxes. Flat pieces, cut to the proper sizes, are given to bed patients who glue them together. When the patient is strong enough to start, corrective and reconditioning work is undertaken. Then ordinary tools are modified in order to suit a particular injury and to give a specific exercise.

In addition to its value in the physical reconditioning of men with muscle and nerve injuries, work with plastics has a therapeutic value for other patients. It furnishes activity and interest to counteract the boredom and depression to which patients may be subject.

FOR wounded soldiers convalescence is a period of active recovery. Active, because the old concept of "all he needs is rest and quiet" has long been tossed into the discard as a dangerous and shortsighted view of what makes a wounded man recover. A soldier who has had a foot blown off by a mine or who has had a hand grenade cut holes in his chest needs not only medical care but also a mental plasma which will help erase some of the spiritual and emotional shock which he experiences when forced to realize that he will never again be like other men. For him, the term "handicapped" is a word heavy with meaning and unless definite steps are taken, he is likely to sink into a mental defeatism which will delay recovery and shadow the rest of his life.

The Army's occupational therapy program for wounded veterans has accomplished wonders in aiding mental and physical recovery. Typical of the way in which the Surgeon General has approached the program is the course for Plastics Technicians now being taught to Medical Corps personnel at the Ordnance School at Aberdeen Proving Ground, Maryland.

The Ordnance Department has made extensive use of transparent plastics in the development of training aids. Its model shop at the Ordnance School is under the supervision of Mr.

* Ordnance School, Training Standards Branch, Aberdeen Proving Ground, Maryland.

H. N. Peavey, industrial designer, who was a pioneer in the development of techniques for the utilization of transparent plastics in the fabrication of training aids. Although the shop is set up to make all sorts of models, it specializes in the machine-working and hand-working of plastic materials. When some of its work was brought to the attention of the Medical Corps in Washington, the Surgeon General requested that a special course be set up to train Medical Corps enlisted men as Plastics Technicians to qualify them to teach wounded soldiers the principles and techniques of hand-working and machine-working plastic materials.

The whole concept of physical therapy is based on the well-founded belief that a wounded man will recover more quickly and more completely if he is kept busy doing things which require him to use both his mind and his muscles and which at the same time leave him with a sense of having accomplished something which stands as visible evidence that he has acquired new skills and abilities.

For these purposes, transparent plastics have some very definite advantages. For one thing they are extremely attractive materials. For another they are very light in weight and thus not too much of a strain on weakened muscles. In learning to work them the student first masters the simple skills involved in using hand tools. Then, under conditions that are exceptionally quiet, clean and safe, he learns how to use a lathe, a drill press, a power saw and a milling machine. Plastic materials can be worked so easily that there is no fear of splinters, cuts or other injuries. As a result, learning progresses much more rapidly than might otherwise be the case. The veteran begins to see the results of his work almost immediately. When he has finished his project, he is left with visible and incontrovertible proof for himself, for his friends and family that he is determined to stand on his own feet.

Perhaps the most important of the therapeutic effects upon veterans who learn to use plastics revolves around the fact that these men—like all soldiers—spend much of their time speculating on what is going to happen to them when they leave the hospitals. Will they walk into an economic depression or will they hold one of the promised 60,000,000 jobs? Whatever the answer these veterans can be certain of one thing: We are on the edge of an era in which plastics should play a major role—and they are getting in on the ground floor.

In planning a training course for Plastics Technicians, Mr. Peavey and the men who worked with him had to take certain factors into consideration.

1. His students would be enlisted men and women from rehabilitation centers and hospitals. With few exceptions, they would be unskilled both in the use of hand tools and in the use of machines. They would have to learn—as their veterans would learn—from the ground up.

2. Because it was probable that a few of the students would have considerable experience with tools and machines the course would have to include enough advanced projects to enable these few to continue to progress without running away from the rest of the class.

3. None of the students would know very much about plastics. The course would therefore have to include some preliminary but non-technical instruction on the physical and chemical nature of plastic materials.

4. Because upon graduation these students would return to hospitals and other institutions where equipment might be lacking, it would be necessary to emphasize only those skills that could be learned by wounded men working with limited machine-shop facilities. It would also be necessary to provide the students with all the information they would need to help them set up a plastics shop and a plastics course.

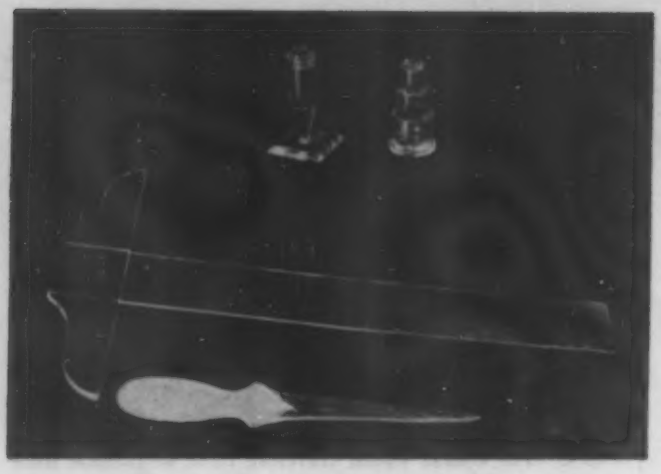
5. Classes would last 8 hours a day for three weeks. Because so many hand skills were involved, most of this time would have to be spent in the shops. The students here, as in the rest of the Army's training program, would learn their new skills by doing.

With these expectations in mind Mr. Peavey planned his course. On only one point did he underestimate his students. He had figured on the usual 8-hour day. Right from the start he found that his students skipped the 10-minute breaks, they cut their lunch hours short and more than 80 percent of them returned to the shop to work on their projects at night.

Only the first 4 hours of the three-week course are spent in the classroom. All the rest of the time is spent in the shop. During these four hours the students are acquainted with the nature of plastic materials with emphasis placed on thermoplastics. Before the first day is over they start to put this knowledge to work in a project which requires them to cut triangles out of cellulose acetate. Before the end of the first week

ALL PHOTOS, COURTESY PICTORIAL SECTION, ORDNANCE SCHOOL

Under the skillful guidance of plastics experts, Army technicians learn the more intricate aspects of shaping and finishing plastic novelties. These men will, in turn, transmit these new skills to their disabled compatriots



At the end of the second week of the training period, such finished pieces as these salt and pepper shakers, T-squares and letter openers are being turned out by the student Technician in the machine shop

each student has made a soap box, a notebook and a picture frame, all of plastic. In addition, if he has time, he is allowed to design and complete a problem of his own.

The second week of the course is devoted to learning how to machine plastics on a lathe and on a milling machine. Hand work continues. By the end of the week the students have turned out a set of candlestick holders made entirely by hand, a letter opener and part of a T-square. In the final week they fabricate individual projects from their own drawings.

The following outline indicates the extent of the training course that is being given Medical Corps personnel at Aberdeen Proving Ground to fit them as instructors in the use of plastics in the Army's occupational therapy program.

A. Types of plastics
   1. Thermoplastics, cellulose acetate and methyl methacrylate
   2. Thermosetting plastics

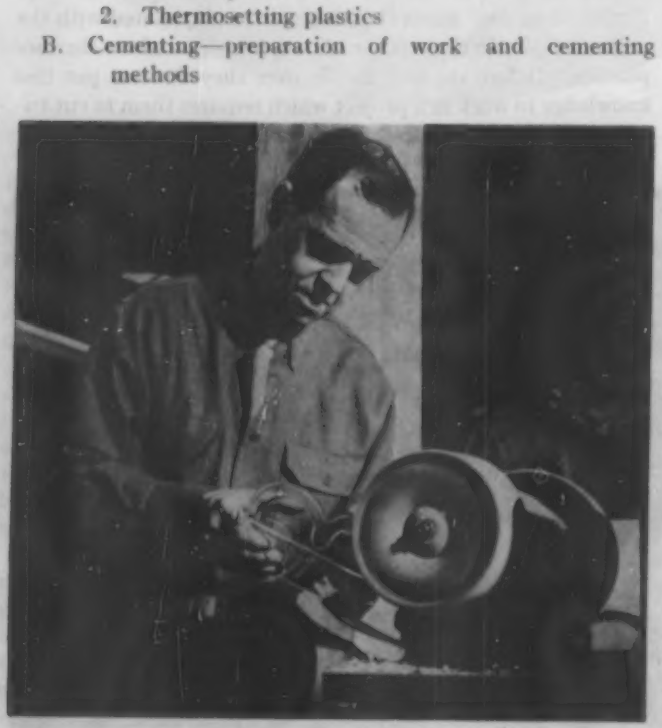
B. Cementing—preparation of work and cementing methods
   1. Preparation—joints, cleaning, jigs
   2. Methods of cementing
      a. Soak method
      b. Straight solvent method

C. Fabrication—10 different operations
   1. Planning
   2. Cutting
   3. Turning
   4. Milling
   5. Shaping
   6. Drilling
   7. Grinding
   8. Sanding
   9. Finishing
   10. Stress relieving

D. Forming—equipment and procedure
   1. Jigs
   2. Methods of forming—hot water and dry heat

The training which patients will get from Medical Corps personnel who are given this course of instruction as Plastics Technicians may have a longer term of value than is now envisioned. For many veterans, working in plastics may become a lifelong hobby. Among those patients who are permanently disabled, the manufacture of small specialty items may become a vocation. And from those men who are not handicapped for life there will probably be some whose interest in plastics will be aroused to a point where they will seek employment in established plastics companies when they finally return to civilian life.

The Ordnance School's course and the projects around which it was built can be very easily adopted and modified for use in the average high school or college shop. No special equipment is needed that cannot be made inexpensively and no special skills are involved which cannot be learned by the average student. The ease and speed with which plastic materials can be machined, the free play they give to persons of imagination and creative ability, the attractiveness of the finished product—all these result in a student motivation that can seldom be surpassed.



A step forward in the Army's program for rehabilitating disabled veterans is the training of Plastics Technicians to serve as teachers of occupational therapy

WACs have proved to be equally adept in the manipulation of band saws and other machines as part of their training for therapeutic guidance in veterans' hospitals

ALL PHOTOS, COURTESY COLUMBIAEN ROPE CO.

Sailing boats incorporating hulls molded of resin impregnated sisal fiber and other improved design features will provide a new racing thrill for the boating enthusiast

Sailboats with molded hulls

RACING this summer on Owasco Lake, New York, will be two new 17-foot sloop-rigged centerboard-type sailboats. To the uninitiated these boats, whether in action or moored in front of the yacht club, will appear to be conventional sailing craft. But to sailing enthusiasts they offer a great deal of interest. If hulls can be molded of reinforced plastic material, better designing features and other advantages, including reduction of maintenance costs and lower production costs, will acrue.

The *Co-Ro-Lite I*, molded of resin-impregnated sisal, was designed by Sparkman and Stephens. It is purely an experimental model, designed to test the adaptability of large compound-curved moldings to the yacht-building industry. Should shipyards prove enthusiastic about this construction, it is the material company's intent to help them set up their own molding equipment for producing the boats.

Developing small boats constructed of impregnated sisal fiber material was an outgrowth of the company's wartime experience in making large moldings such as expendable jettison tanks, engine nacelles, glider noses and hatch covers. The jettison tanks, 9 ft. long, of tear-drop design, were built with no inside ribs, stiffeners or baffles. Yet they had to support, without leaking, a load eight times greater than the tank itself when loaded with fuel. The shells of these tanks, which had to support 10,000 lb. equally distributed over the surface, could not exceed 40 lb. in weight. The experience gained in molding these tanks was thought to be applicable to fashioning a strong, lightweight boat hull.

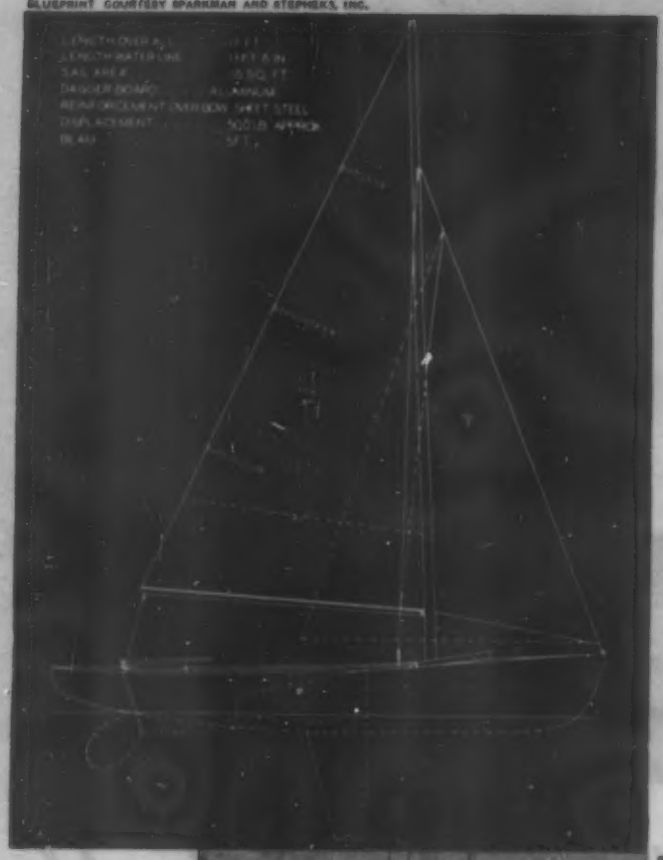
The reinforcements in the hull material are the long, tough, resilient sisal fibers, carded and worked into fluffy batting, and consolidated by a needling operation which drives the tough tufts of the fibers into a thick mass. The coarse fabric which results is $^3/_4$ in. or more in thickness, with a bulk ratio of one to ten, or one part fiber to ten parts void space.

To mold the hull, the thick blanket of rope fibers was first cut into the rough shape of the hull. The blanket was mechanically dusted in a vibrator machine with a powdered phenol-formaldehyde resin which sifted through its interstices. Resin content was 50 to 55 percent.

Ordinarily, the mold for the hull would be constructed of the conventional cast aluminum or sheet steel, but at the time it was built foundries and sheet steel fabricators were unable to spare the time. Consequently sheet aluminum was employed and fabricated in the aluminum division of the material company. The hull mold was ready late in January and two weeks later the blanket of rope and resin was ready.

Placed in the mold, the sisal fiber blanket was pressed by hand into the pointed curve of the bow and around the stern. Additional pieces were added in a few spots where extra thickness was needed. [In mass production the hull will be preformed in a mandrel press under slight heat. When the resin impregnant cools, the material will assume a semi-rigid shape. It will thus be easier to trim and place in the mold for curing and compressing.] In molding the *Co-Ro-Lite I*, however, it was necessary to fit the work into the mold by slitting the sides of the blanket at the stern and bow so that the material could be punched into place.

When the work was ready in the mold, the open side was sealed with a rubber blanket. Exhaustion of the air through the vacuum line immediately put 14 p.s.i. of pressure on the



mold. This was increased to 80 lb. when the mold was wheeled into the autoclave, where steam pressure was applied. The work was left in the autoclave for half an hour at a temperature of 323° F. for curing and compressing.

Although the hull had a smooth, hard surface when it was taken from the mold, in preparing it for the water it was necessary to give it a coat of conventional marine paint, for the material has a certain amount of water absorption.

The deck mold, prepared in the same way as the mold for the hull, was finished a week or two later, and the deck was molded in March 1945. In designing the boats, a flange is left on both the molded hull and the molded deck sections to facilitate the fitting and screwing together of these two parts.

When the first hull was molded, the material was cut and placed in the mold in about eight hours. A second hull, produced for the *Co-Ro-Lite II*, required about six hours. It is estimated that, in production runs, a hull could be set up in the mold and the rubber blanket put in place in less than two hours. With a curing time of 20 min., using two hull molds, four men should be able to turn out two hulls per hour, ready to be trimmed and assembled to the decks.

The weight of the hull, with no ribs or internal bracing but with extra thickness around the keel, shear line and the section where the mast was to be stepped, was 185 pounds. The deck weighed 80 lb., bringing the weight to 265 pounds. Fully rigged, the boats will range from 320 lb. to 500 lbs., depending on the safety factors incorporated.

The material, with a specific gravity slightly greater than that of water, provides a hull which will not float if filled with water. For this reason flotation cells are incorporated in the design of the *Co-Ro-Lite I*. Made of an expanded plastic material, they are encased in canvas skins placed in the bow and stern. The plastic cells are considered safer than the metal air tanks used as flotation cells in metal boats because when the metal seams open under stresses and strains of sailing, the safety factor is lost.

It is believed that in molding the boat, the phenolic sisal

3—The graceful lines of the molded hull are seen to advantage in this experimental model designed to test the adaptability of large compound moldings for boat building

4—To facilitate fitting and screwing together of the molded hull and deck sections, the parts were designed with a flange. The operator is trimming the flange after removal of the hull from the mold

material offers a great time-saving over plywood, for it is available in single strips of any desired size or thickness and does not have to be built up or stapled together in the mold. In addition to the ease of loading the mold, the material does not require expensive molds and is easily made into compound curvatures.

In building the *Co-Ro-Lite I* every safety factor deemed advisable was incorporated, producing a somewhat heavier boat than had been expected. The bow plate of steel, a mast-raking mechanism, and heavier than necessary floor boards added weight. The *Co-Ro-Lite II* will have a thinner hull with a shell lighter by 15 pounds. Instead of a steel bow plate, it will have only a small piece of half-rounded brass at the bow, and other economies in fittings are expected to reduce the weight by 150 pounds. Further changes will be a larger cockpit for increased sailing comfort, and an addition of 18 in. to the boom to make possible a larger mainsail.

Perhaps the chief advantage in the resin-impregnated sisal boat is the fact that there are no seams to be caulked. The monocoque construction offers a boat which, once built, does not have to be worked over each season, aside from painting. It also offers a clean interior, with no ribs to catch dirt. In addition, submersion tests conducted in Florida waters show the plastic material to resist penetration by barnacles and other growth. It is absolutely resistant to marine borers.

Sails on the *Co-Ro-Lite I* were made of nylon (3 oz. per sq. yd.) by Ratsey and Lapthorn.

This summer the two phenolic sisal boats will be tested under all types of conditions, sailed by many different sailors. Already deemed a success by its designer, Olin Stephens, and its sailmaker, Colin Ratsey, men who have participated in International Cup Races, it is expected that the *Co-Ro-Lite I* will be followed after the war by a fleet of small boats in the same "plastic" class.

Credits—Material: Hull and deck, Co-Ro-Lite, based on Durez; sail, Nylon. Boat developed by Columbian Rope Co., Allied Products Div. Designed by Sparkman and Stephens, Inc.

5

6

5—Interior of hull showing frame. Flotation cells of expanded plastic encased in canvas skins insure the hull's floating when filled with water

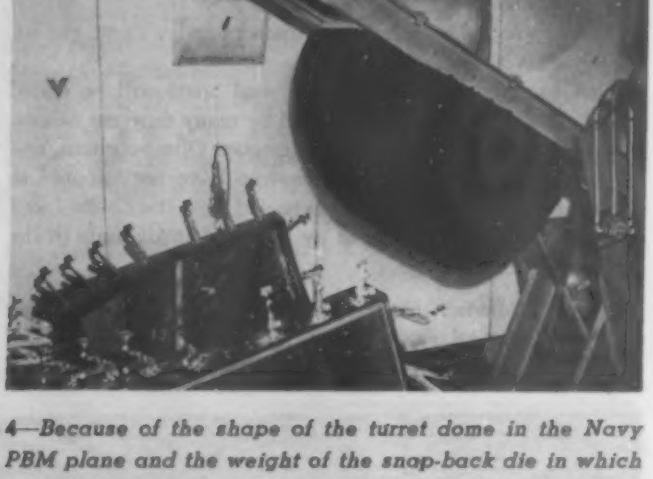
6—The advantages of monocoque construction are evident in this deck, also molded of resin impregnated sisal fiber. This section weighs 80 pounds

7—When the hull is removed from the mold it has a smooth hard surface. Before it is ready for the water it will be coated with marine paint

1—A vacuum die is employed in the forming of a methyl methacrylate machine gun turret dome. This transparent acrylic dome is used on several types of Army bombers. Two operators are shown in the act of removing a finished dome from the vacuum die in which it was formed

2—Gun-sighting domes for the B-29 are formed in a free-blowing die. In this method the preheated sheets of laminated methyl methacrylate-polyvinyl butyral take shape in the die in much the same manner that soap bubbles expand, the final form depending upon vacuum control

3—Each gun-sighting dome is spot checked for optical flows after which the flange is cut away and a rubber mounting strip applied around the rim of the base to insure a snug fit. Free blowing eliminates the mark-off normally present



4—Because of the shape of the turret dome in the Navy PBM plane and the weight of the snap-back die in which this enclosure is formed, it was found necessary to build a crane to lower the mold into position and slide it into place

5—After the upper half of the snap-back die has been lifted from a completely formed section of a turret dome, the part is given a preliminary polishing. The enclosure is then lifted from the mold, ready to be assembled

6—A protective masking is applied to all enclosure pieces after the forming operation. The liquid resin compound dries quickly and forms a tough skin which prevents damage during fabrication and shipping

Forming transparent enclosures

JUST as transparent airplane enclosures differ in size and shape according to the uses to which they are put, so the methods of forming these glazings vary with the designs of the parts. In the plant at which the accompanying photographs were taken, four different processes are used—simple forming, deep drawing, free blowing and snap back.

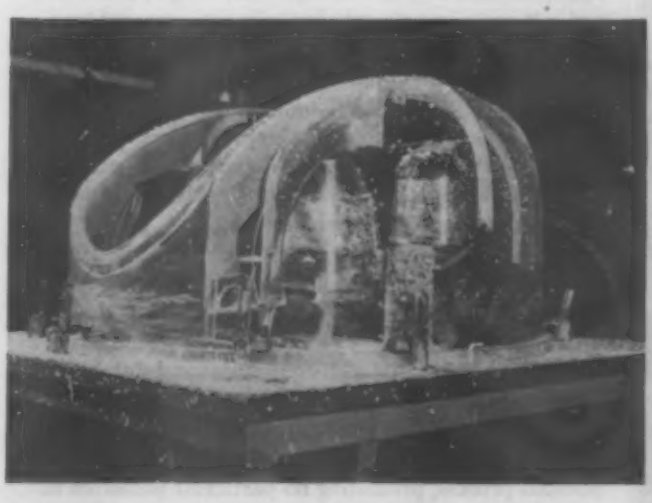
For the methyl methacrylate machine gun turret dome that is used on a number of Army bombers, deep drawing was selected as the most satisfactory method. The gun sight dome for the B-29 Superfortress, on the other hand, is formed by free blowing. In this process no forms or molds are used, the laminated methyl methacrylate polyvinyl butyral sheet being restrained only at the edges. The final shape depends entirely upon pressure control. The snap-back forming used for the turret dome of the Navy PBM was developed as a compromise between the optical advantages of free-blowing and the contour control advantages of stretch forming. In this method the preheated methyl methacrylate sheet is first free-vacuumed to an enlarged approximation of the shape required. A plug, or die, accurately conforming to the finished shape desired is then inserted in the preformed plastic and the vacuum released to allow the material to snap back slowly and fit snugly over the form block. In each case the design of the enclosure and the application for which it was designed decided the method of forming the part.

Credits—Material: Lucite and Lucite-Butacite. Forming by E. L. Cournand, Inc., for Navy Air Corps and Army Air Forces

PHOTOS NO. 4 AND 5, COURTESY E. L. COURNAND, INC. ALL OTHER PHOTOS, COURTESY E. I. DU PONT DE NEMOURS AND CO., INC.

10—*Two inspectors are shown checking the domes for possible flaws before the parts leave the final assembly operation. An additional inspection is also made before the domes finally are sent out from the plant*

9—*Since the optical clarity of the methyl methacrylate turret domes on the Navy PBM flying boat is of great importance, each of these enclosures is carefully checked with a telescopic sight. Here a woman employee uses an electrically operated telescope sight to check a large turret dome*



7—*Cutting and facing operations are effected on the turret dome of a Navy PBM by means of a hand drill. His face protected by a mask, the operator is shown working inside the dome which is set up on a platform*

8—*After the machine gun turret dome of a Navy PBM plane has been fully assembled, a number of finishing operations are necessary, such as this work being done with a portable router. Contour tolerance of $^{1}/_{16}$ in. is maintained*

MEASURING CUPS FOR WATER MAY SEEM at first glance a trivial, unimportant part of a Navy flier's equipment. But when a group of these men are adrift on a single life raft, the careful doling out of a treasured quantity of water assumes major significance in their survival. These cups, containing 20 half-ounce graduation markings molded into one wall, are so designed that a pint tin of water fits into them.

The cups, injection molded of polystyrene in a 2-cavity die, are $3^1/_2$ in. high, $4^1/_4$ in. wide and 2 in. from front to back wall. The walls themselves are $^1/_8$ in. thick. Near the top of each cup is a small hole, about $^1/_{16}$ in. in diameter, through which is drawn a loop of waterproof, mildew-proof lanyard for anchoring the cup to the life raft or for fastening it to the flier's person.

One of the main difficulties in setting up this project was the building of a die that would produce castings with the proper dimensions, so that the water container would fit snugly into the plastic cup. Also, close control had to be maintained over molding to insure close tolerances. As a final check the cup was gaged for close tolerances and had to withstand a breakage test.

Credits—Materials: Styron and Bakelite polystyrene. Molded by Cruser Mfg. Co. for U. S. Navy Air Corps

PLASTICS

A MECHANICAL MANICURIST THAT BRINGS all of the professional touch of the beauty shop to milady's boudoir will soon be on the market after a wartime holiday which was necessitated by the use of its materials for more essential war items. Formerly employed only in professional beauty shops, this neat and self-contained electrical manicurist, powered by a $^1/_{20}$-hp. motor, is equipped with attachments for filing, buffing and scrubbing the nails. It contains, also, a reciprocating unit for loosening and rolling back cuticle. One of the equipment's special features is the stimulation that is afforded by a massaging attachment. This particular device is standard equipment with each mechanical manicurist set.

Plastic elements of the Beautiator—as it is called by its manufacturer—consist of the housing and the cover for the drill, which are compression molded of urea. This material was retained in the manufacture of these items because of its toughness and durability as well as its ease in cleaning, properties which had proved themselves throughout many years of production. The molding of these parts is a straight, uncomplicated process, presenting no particular problems to the molder.

Credits—Material: Bakelite urea. Molded by International Molded Plastics, Inc., for Abar Mfg. Co.

GARDEN CHAIRS WHICH ARE AS GAY AND colorful as they are practical, will enhance the scene this summer, thanks to the excellent properties of the vinyl elastic strappings which form the backs and seats. This "Put-A-Way" folding and demountable outdoor furniture, featured in the Fifth Avenue windows of W. and J. Sloane, can be readily adjusted to three different positions. It was made not only to withstand the often damaging effects of all types of outdoor weather to which it is exposed—streaming sun, pouring rain and extremes of heat and cold—but also to be folded or taken apart in a jiffy so that it can be stored away in a minimum of space.

Washable, acidproof, non-abrasive, the extruded vinyl elastic strappings are resilient enough to conform to the shape of the body and to provide a maximum of bodily comfort—an advantage which is often sadly lacking in summer furniture, as anyone who has used it will attest. The frames of the chairs are built of cypress with a natural waterproof finish—making a pleasant combination with the white and brown, brown and yellow or yellow and white plastic lattices which are interwoven through them.

Credits—Material: Koroseal. Designed by V. F. V. Gerstel and Ferdinand Kramer of the Products Development Division

PRODUCTS*

THE SUNDAY SAILOR WITH A LONGING TO be a good navigator now has available for his use a sextant originally developed for and adopted by the U. S. Maritime Commission and the War Shipping Administration for the life boats in their ships. This D-B sextant, which contains 18 injection-molded parts of heat-resistant methyl methacrylate, was designed to meet rigid accuracy requirements and offer resistance to extreme fluctuations of heat and humidity which it might encounter while in service and to corrosion from the salt spray.

In addition to the other plastic parts—measuring arm, frame, sight tube assembly, horizon mirror assembly and wide mirror assembly—are two sun screens so located that neither direct nor reflected sunlight will enter the eye. Each screen consists of two heavy 0.060-in. molded plastic pieces which are of different color and intensity.

Distinctive features of the instrument, usually not found in any but the most expensive, are the 1-in. diameter, micro-adjusting screw for final settings of the vernier and the ease of realigning mirrors thrown out of parallelism.

Credits—Material. Lucite. Molded by Dillon Beck Mfg. Co. Distributed by Graham Products, Inc.

* Reg. U. S. Pat. Office.

Units such as these bomb detonators helped clear the road of pillboxes, tank blocks, etc., for swiftly moving Allied armies in the European theater. Shown here are the phenolic detonator case (top), detonator with threaded priming adaptor (center), cap protector (bottom)

Fifteen seconds to jump . . .

. . . is all the G.I. has when he sets off an explosive charge with this fast-acting detonator. Enclosed in a protective cast phenolic case, the prefabricated detonator eliminates time required for assembling the conventional detonator in the field

HOUSED in its olive-drab cast phenolic case, the 15-second delay detonator looks as innocuous as a fountain pen; actually, it is about as harmless as a large lucifer match. In the hands of an Engineers Corpsman bent on destruction, it sets off the blast that blows up pillboxes, demolishes tank blocks, tears up railroad tracks and wrecks enemy installations in general.

A detonator has three essential components: a fuze lighter consisting of a pull wire which ignites a flash compound; a fuze, enclosed in a special tube, which is ignited by the fuze lighter; and a shell containing a base charge and a priming charge. Usually these parts come separately and are assembled by the unit that is going to use them.

By means of a threaded priming adaptor (shown above, center), an assembled unit can be screwed into such standard high explosives as Bangalore torpedoes, T.N.T., antitank mines, and the like. The fuze has a known burning rate and is cut to a length which will allow a specified number of minutes' delay before the explosive is detonated.

Sometimes it is expedient to have an extremely short delay period—just long enough for the man who sets the charge to jump nimbly out of the way. A good example of the need for speedy action is the demolition of an enemy pillbox, when a protracted interval of delay would give its occupants time to prevent the explosion.

It was for enterprises of this sort that the 15-second delay detonator was developed. Prefabricated and enclosed in its cast phenolic case and cap protector, it eliminates the assembly time required by other types of detonators. The user has only to follow the laconic instructions stamped on the case, namely, 1) twist off the cap, 2) screw the threaded adaptor into the nipple of the explosive, 3) withdraw the cotter pin and 4) give the ring attached to the pull wire of the fuze lighter a vigorous yank. Then (not included in the instructions) he has to jump.

The case and cap protector are supplied to the fabricator by the materials manufacturer in the form of two castings approximately 3 in. long and $^{11}/_{16}$ in. in diameter. Each requires 10 fabricating operations before it is ready to be inspected and forwarded to the loading station where the detonators are assembled and packed for shipment to war theaters.

The first four operations are identical for both case and cap. The flash is removed, the parts are washed, dried in sawdust, and their exposed ends given a slight bevel. At this point the routines for the two pieces vary.

A hole which the loader will fill with a sulfur compound to seal the firing mechanism in place is drilled in the case, and 3 small holes, two for the cotter pin and one to act as an air vent when the larger hole is stopped. Before each case goes to the tumbling barrel for the dull finish required by the military, the end receiving the firing ring is counterbored.

The adaptor, a zinc die casting which has been knurled so that it will be held in place by friction, is inserted by a kick press or, when production must be speeded up, by a special inserting machine. This consists of a turntable provided with 7 stations to hold as many cases. Castings are fed through a chute to the press mechanism, which forces one into each casting as the table revolves. (*Please turn to page 192*)

PLASTICS*

Engineering Section

F. B. STANLEY, Editor

Core materials for sandwich structures

The development of synthetic core materials for sandwich-type structures marks a major step toward the utilization of this construction in such parts as airplane fuselages. Work that has been done to date in this field is summarized and evaluated in the following articles, written by authorities in their respective fields

by CAPT. G. B. RHEINFRANK, JR., and CAPT. W. A. NORMAN†

SINCE the successful flight of the Army Air Forces laminated glass sandwich fuselage for the BT-15 airplane described in the May 1944 issue of MODERN PLASTICS, the technique of this development has advanced by leaps and bounds. Engineers of the Air Technical Service Command, Wright Field, have been working on development and evaluation of synthetic core materials for sandwich structures.

Aircraft designers have for a long time recognized that substantially increased performance can be obtained if the exterior surfaces of aircraft can be made smoother and more stable. One pursuit airplane, it is known, lost 23 m.p.h. in high-speed performance tests because its exterior skin was not perfectly smooth. In an effort to improve the exterior surface of the conventional type metal structures, it was essential that the possibilities of using new materials in sandwich-type structures be investigated. This type of construction consists of a thick, lightweight, low-strength core material faced with a thin, high-strength material. A typical example is the DeHaviland Mosquito, which makes use of a $^{7}/_{16}$-in. balsa core faced with $^{3}/_{32}$-in. birch plywood.

The advantages of a sandwich-type structure are threefold:

1. Performance advantages include greater aerodynamic efficiency due to high buckling strengths and elimination of rivets and laps. Greater dampening capacity under vibration and better insulating qualities, both thermal and accoustical, are inherent in this type of construction.

2. Fabrication advantages are evident due to the practicability of molding integral sections in one operation. The simplicity of structure requires a minimum of component parts and thereby contributes to a substantial reduction in man-hours and skilled labor compared to that necessary for the conventional metal aircraft.

3. Design advantages are also evident from the basic simplicity of the structure. The greater part of the internal stiffening structure is eliminated due to the stability of the sandwich-type structure.

Although the British used a complete wooden sandwich for the Mosquito, the United States Army Air Forces have made but limited use of this type of sandwich structure since wood was considered a marginal material for combat aircraft which must operate under extreme weather conditions.

A major step toward the utilization of a sandwich-type structure was the development of a facing material other than wood which possessed adequate strength, uniform properties, weatherability and dimensional stability. The suitability of glass fiber for this application was indicated by the performance of an experimental fuselage assembly for the BT-15 airplane constructed of a glass fiber balsa sandwich. According to tests conducted at the Air Technical Service Command, Wright Field, this fuselage, the first successful laminated plastic aircraft primary structure, proved 50 percent stronger for its weight than the standard metal section.

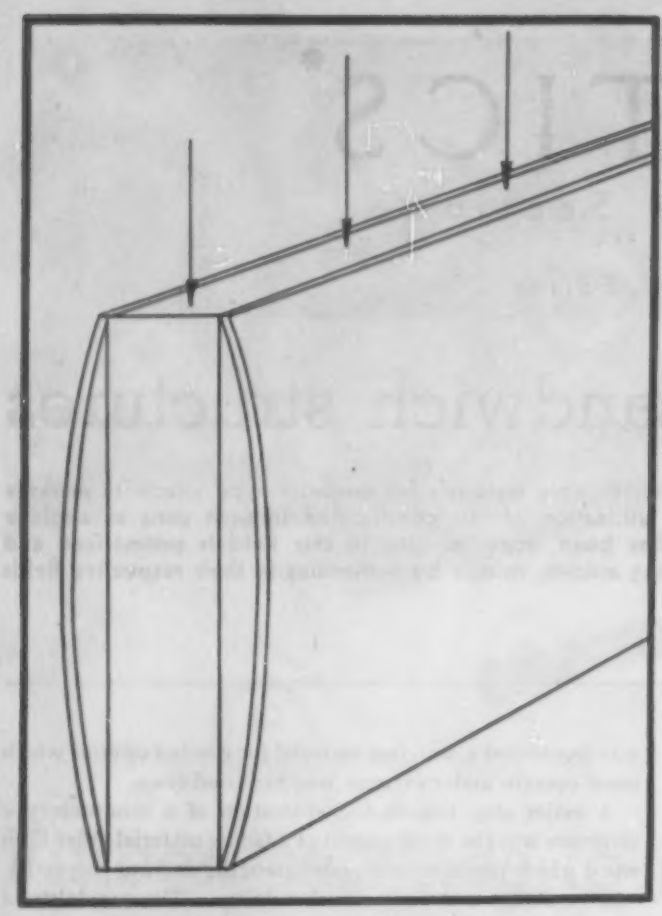
With the wooden skin eliminated from the sandwich, the next problem was the substitution of some other material for the wooden core. This involved the development of a low-density synthetic core material having adequate strength, low moisture absorption and dimensional stability. It was essential that the density and properties of the material be uniform and controllable in manufacture.

The primary function of this low-density core material is to stabilize the thin high-strength faces so that they will develop a substantial portion of their ultimate compressive strength without buckling. To accomplish this, the core must be strong enough in tension, normal to the surface, so there is no buckling of the faces through tension failure in the core itself. Examples of this type of failure are shown in Figs. 1, 2 and 4. Further, compression strength of the core material normal to the faces must be sufficient to resist local loads usually encountered in service due to rough handling. A failure of this type is demonstrated in Fig. 5. The necessary compressive strength of the core material parallel to the faces is governed by the modulus of the material. The relationship of the compressive modulus to the compressive strength of the core must be such that the core will not fail before the faces develop their maximum strength. Figure 3 shows a premature failure due to a low-strength modulus ratio.

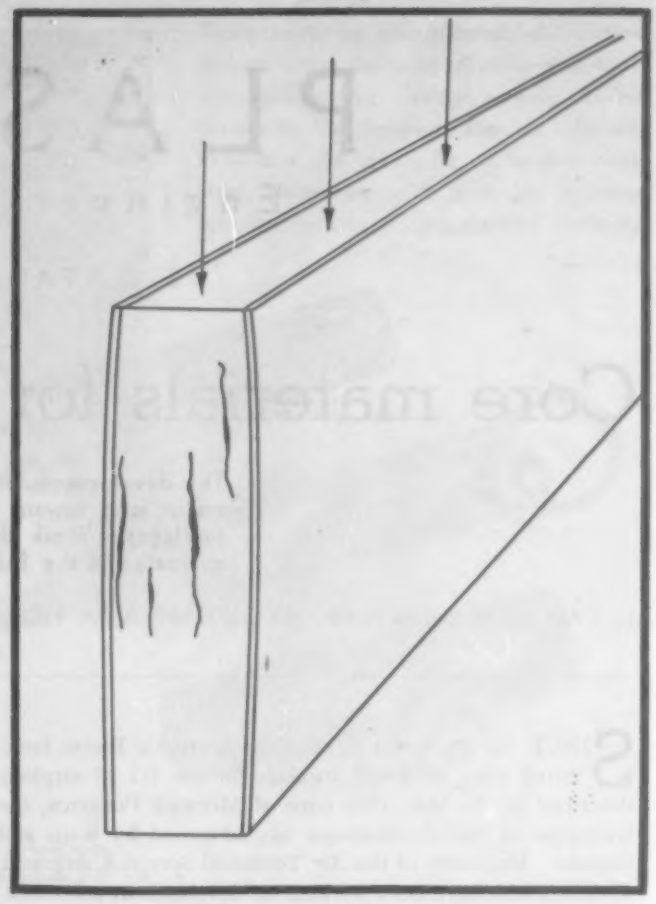
The shear rigidity of the core must be enough to hold the entire sandwich combination stable before the faces develop their full strength. A sandwich having a soft rubber-like core would fail prematurely. Such a condition is shown in

† Aircraft Laboratory, Engineering Division, U. S. Army Air Forces, Air Technical Service Command, Wright Field.

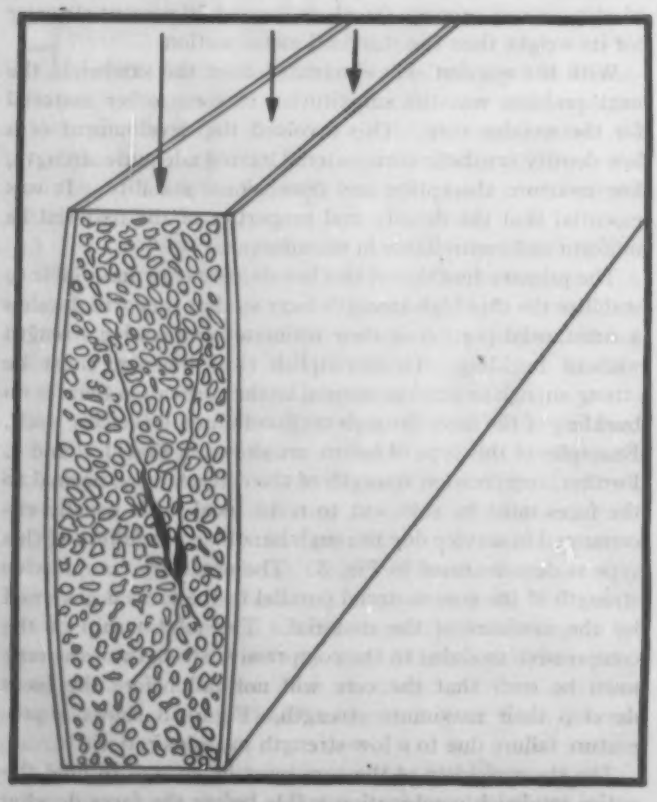
* Reg. U. S. Patent Office.



2—Example of failure of sandwich due to poor bonding between faces and the core which resulted in delamination. Specimen subjected to compressive load as shown by arrows



1—An instance of failure in the core due to the weakness of fibrous core in tension. The specimen was subjected to a compressive load as shown by arrows



3—Failure due to the use of a brittle, granular core. The sandwich was subjected to compressive load as indicated

Fig. 6. Shear failure may occur as shown in Figs. 7 and 8. A satisfactory core material must not be brittle or granular since materials with these properties possess poor impact and vibration characteristics. Sandstone-type materials fall into this category (Fig. 9). The type of failure occurring in a sandwich having a core with satisfactory properties is illustrated in Fig. 10. In this example, the face has developed its compressive strength.

In order that synthetic core materials would satisfactorily fulfill the requirements as outlined, it was necessary to establish minimum physical properties based on preliminary experimental testing. These properties, as tentatively established by the Air Technical Service Command, are as follows:

I. Specific mechanical properties, room-temperature

a. Specific tensile strength flatwise, minimum 2000

b. Specific compressive strength flatwise, minimum (at fracture or sudden yielding, or at 2 percent strain, whichever is lowest) 1000

c. Specific modulus of rigidity associated with shear distortion in planes parallel to the edge plane, minimum 40,000

d. Specific shear strength in whichever direction is the weakest in shear, minimum 1000

e. Compression and tension edgewise (lengthwise or crosswise in

the plane of the sheet) strain before any type of failure occurs, minimum.....2 percent

f. Type of compression failure.....no crumbling or disintegrating

g. Impact strength (falling ball impact test), minimum.....1½ ft./lb.

II. Specific gravity

a. If the material has the specific properties given in Paragraph I, a specific gravity in the range of 0.05 to 0.15 is suitable. A minimum of 0.09 is preferred because of the actual or absolute values of the mechanical properties obtainable. Lower specific gravity materials with properties equal to those specified above for 0.09 or higher specific gravity materials would, of course, be better, if possible of attainment. (Multiply specific strength values given above by specific gravity of material to obtain required properties in pounds per square inch. Impact strength and strain values are not specified.)

III. Effect of temperature

a. Not more than 25 percent decrease in mechanical properties at 160° F., compared to room temperature values.

b. Not more than 10 percent decrease in mechanical properties after 240 hr. at 200° F., dry heat, tested at room temperature.

c. At least 2 percent compression or tension strain before failure at −70° F.; at least ¾ ft./lb. impact strength.

IV. Weathering effect

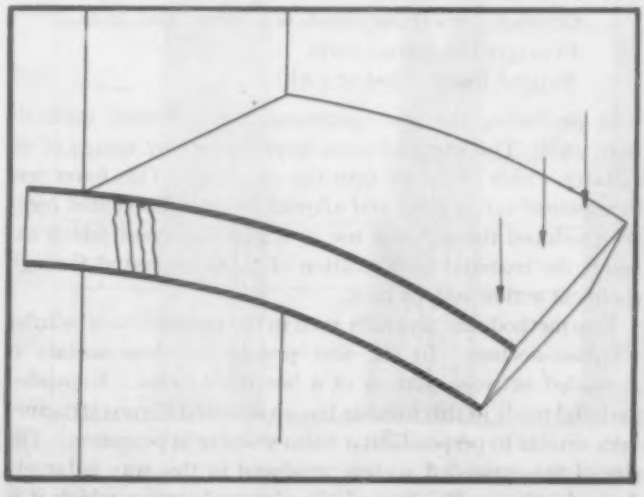
a. Not more than 10 percent decrease in mechanical properties or more than 5 percent warp or twist after 240 hr. accelerated weathering, or after 6 months outdoor weathering.

b. Not more than 10 percent decrease in mechanical properties after 240 hr. exposure to 95 percent relative humidity at room temperature, tested wet.

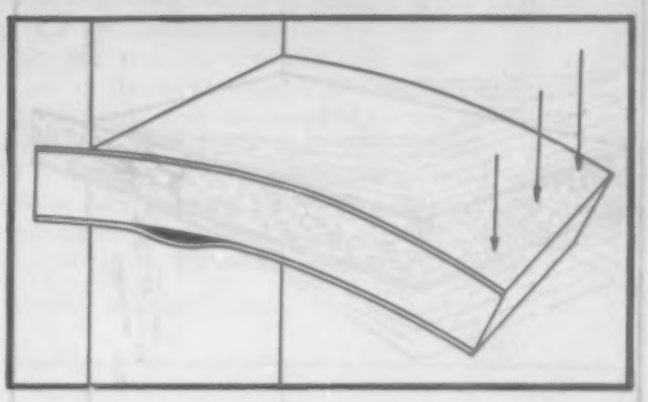
1. Weight increase in above test, 10 percent maximum.
2. Dimensional change in length, 2 percent maximum, width, length or thickness.

V. Resistance to chemicals

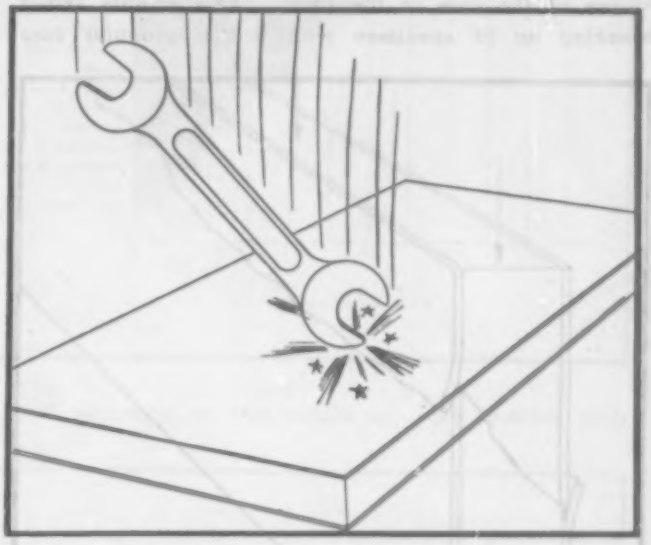
a. Shall be resistant to aromatic fuel, engine coolants, deicer hydraulic fluids. (*Please turn to next page*)



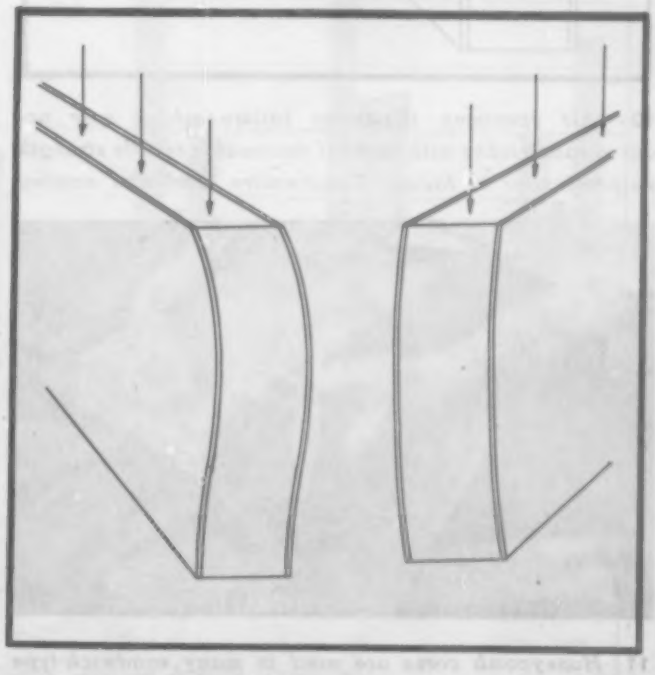
7—Example of failure of core in shear, perpendicular to faces. Specimen was subjected to flexure as shown



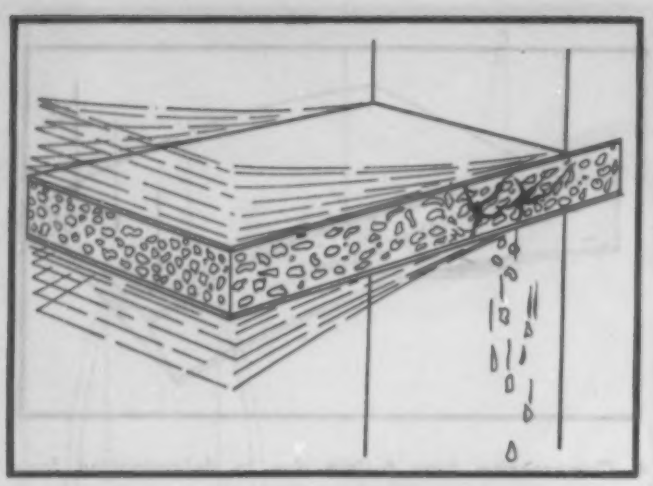
4—Compression face failure due to delamination from core. Specimen subjected to flexure as shown by arrows



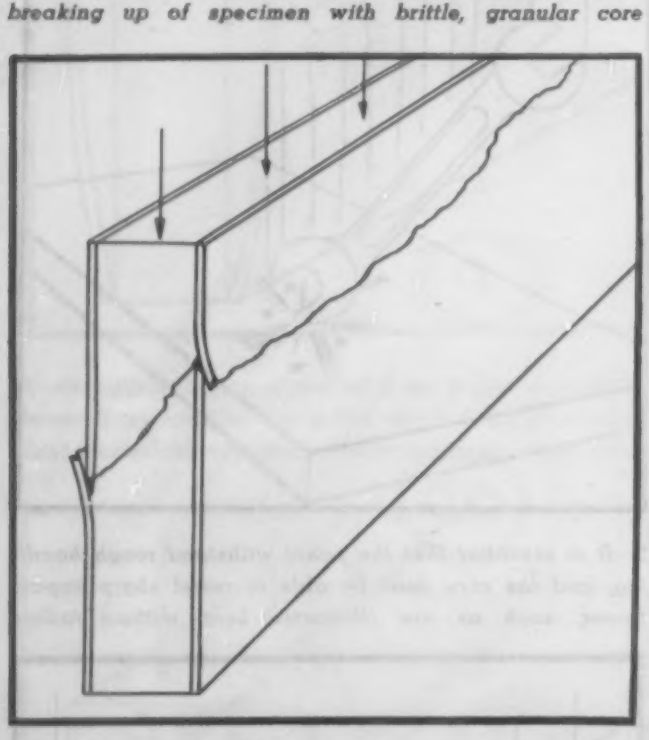
5—It is essential that the panel withstand rough handling, and the core must be able to resist sharp impact forces, such as are illustrated here, without failure



6—Instability failure in these specimens was due to low modulus of rigidity of core. Load was compressive

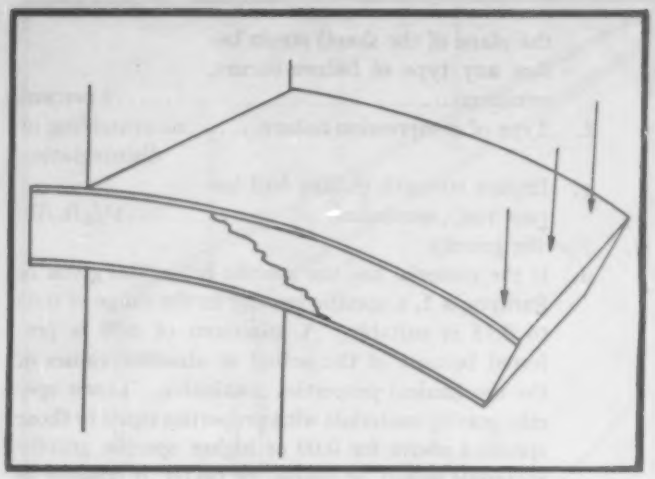


9—A panel must be able to withstand vibration without failure of the core or the faces. This sample shows breaking up of specimen with brittle, granular core



10—This specimen illustrates failure which may occur in sandwiches with cores of reasonable tensile strength perpendicular to faces. Compressive load was exerted

11—Honeycomb cores are used in many sandwich-type structures. These cores are made in blocks and slices cut away according to the use to which they are put



8—This test specimen of sandwich-type construction illustrates failure of the core in diagonal shear. The piece was subjected to flexure as shown by the arrows

VI. Flammability
   a. Shall be self-extinguishing or have a burning rate of not more than 2 in. per minute.

For the purpose of a preliminary valuation of the various core materials proposed for use in a sandwich-type structure, a number of tests were run. For the compression tests, specimens 3 in. by 4 in. by $^1/_2$ in. thick were faced with 5 plys of ECC-11-112 glass fiber cloth. To prevent local failure, clamps were placed on the ends of the specimen. In the case of the tension tests, designed to show the relative ability of various core materials to support the faces under load, the specimens were made by gluing the core materials between maple blocks. Relative flexural rigidity and ultimate strength of the sandwiches were determined from tests carried out in panels, 30 in. by 12 in. by $^1/_2$ in. thick, using various cores with similar faces. Panels were supported at ends and tested in bending, load being applied at a third point.

The cores that were tested fell under eight general classes.

1. Foamed thermosetting (phenolics, ureas or copolymer) resins
2. Foamed thermoplastic (cellular cellulose acetate, polystyrene) resins
3. Foamed rubbers
4. Foamed glass
5. Foamed calcium alginate
6. Gridded cores (honeycomb or square filled grid)
7. Impregnated fibrous cores
8. Natural (balsa wood or cork)

In producing the test specimens, the following methods were used: The whipped cores were foamed by means of an agitator which beats air into the material. This foam was then poured into a form and allowed to set. Expanded cores are produced through the use of a foaming agent which expands the material by liberation of gases generated through chemical action and/or heat.

Two methods are generally used in the production of cellular cellulose acetate. In the first process cellulose acetate is expanded between platens of a hot plate press. Expanded material made in this manner has an oriented fibrous structure very similar to perpendicular balsa wood in appearance. The size of the expanded acetate produced in this way is largely dependent upon the area of the platens between which it is expanded. Extrusion is another method now employed in the manufacture of cellular cellulose acetate. Material ex-

panded in this manner is isotropic and can be extruded continuously. It is supplied in ribbons, some measuring $2^{3}/_{8}$ in. wide by $^{5}/_{8}$ in. thick.

Of the many types of gridded cores investigated by the Air Technical Service Command, the most promising is a honeycomb core very similar in appearance to the inside of a common automobile radiator. Figure 11 shows a close-up of this core. The grids are generally made of a material similar to the face plies with which they are used and are shaped in such a way as to contain as much as 95 percent voids by volume. There is no reasonable limitation as to the nature or size of the cell structure. The particular honeycomb core shown in Fig. 11 is made up of small hexagons $^{3}/_{16}$ in. in diameter and in the photograph are being sliced $^{1}/_{2}$ in. in thickness. Fibrous cores are manufactured by impregnating cellulose or synthetic material with a binder, generally a phenolic resin. This serves to make the fiber rigid.

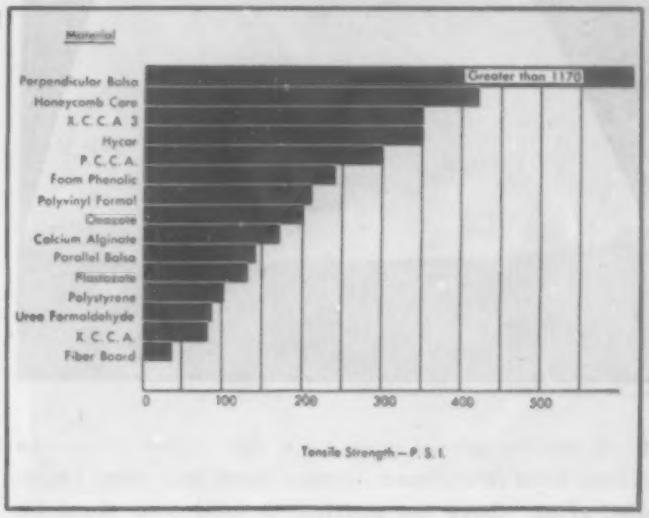
Tests indicated that certain types of cores such as the hycar cores, honeycomb glass cores and cores of cellular cellulose acetate containing 3 percent chopped glass fiber had sufficient physical properties to develop a substantial portion of the compressive strength in glass cloth faces. A comparison of the test results on these materials and on perpendicular and parallel balsa sandwiches is given in Fig. 13.

Various compressive tests were carried out on cores in sandwich combinations having glass cloth faces. The compressive stress developed in the facing material ranged from 8000 to 36,000 p.s.i. upon the core material and the thickness of the faces. Certain brittle cores such as alginate which had reasonably high tensile strength failed prematurely before developing maximum strength in the faces because of their low strain at ultimate.

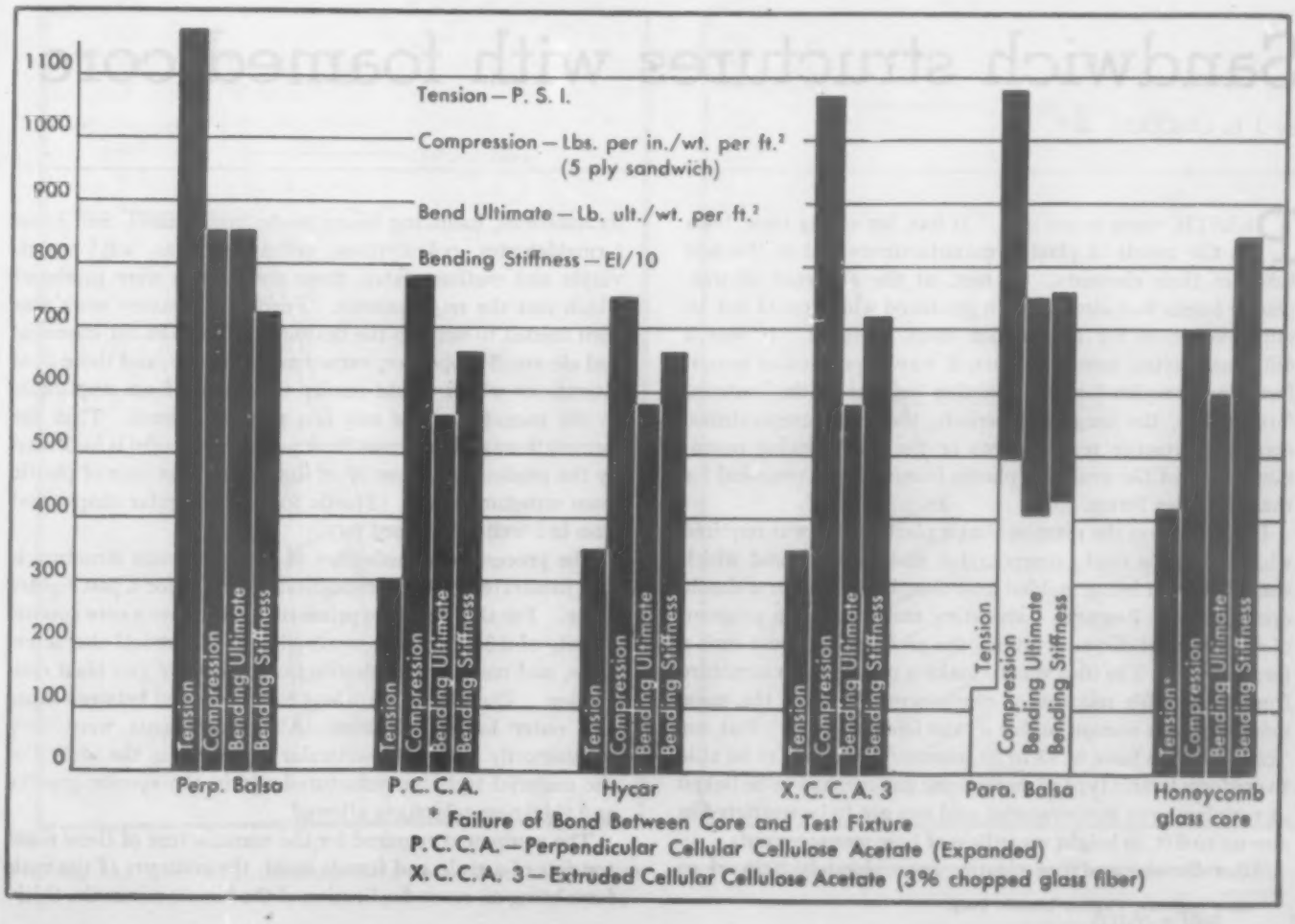
Bending tests indicate that with cores of comparable properties the strength and stiffness of the sandwich combination were more dependent upon the relation of core and face thickness than upon the physical properties of the core itself. All bending failures occurred in the compression face either by compressive failure of the face or by delamination (tension failure of core). All tests were conducted at Air Technical Service Command, Wright Field.

Credits—Material: Fiberglas

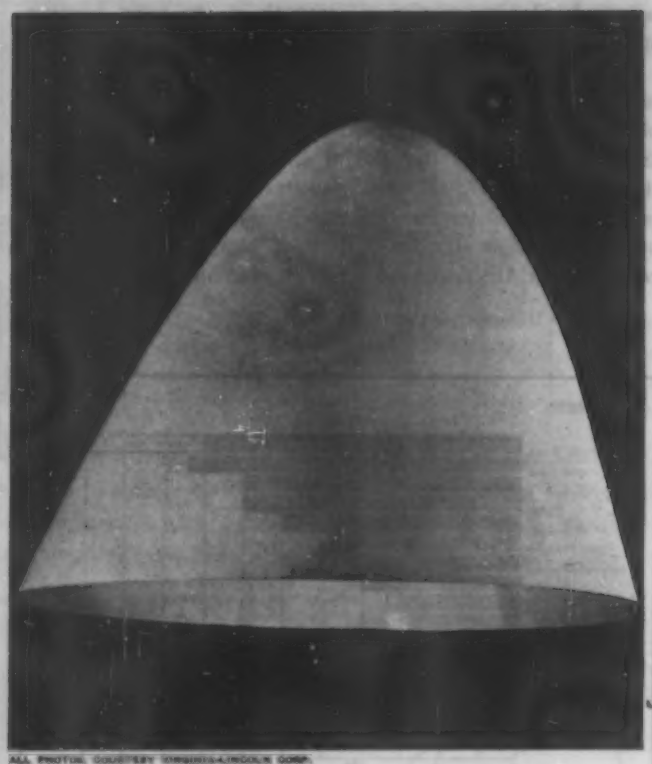
12



12—*A summary of the results of core tension tests*



13—*A charting of test data on sandwich core material*



ALL PHOTOS, COURTESY VIRGINIA-LINCOLN CORP.

1—In this completed nose for a fast fighter plane the plastic foam is enclosed between inner and outer laminated skins. Since the structure is used as a cover for electrical equipment it was necessary for the material to have excellent weathering and electrical properties

2—The various layers in the construction of the dome are clearly evident in this cut-away section. Reading from bottom to top there is, first, the outer skin alone. Next comes the outer skin and a layer of foam, then a reinforcing skin and, finally, the inner skin of the dome

Sandwich structures with foamed core

by J. D. LINCOLN, JR.*

PLASTIC foam is not new. It has, for a long time, been on the minds of plastics manufacturers and in the test tubes of their chemists. In fact, at the outbreak of war, plastic foams had already been produced which could not be improved upon for use as flat stock material. It was a different matter, however, when it was a question of manufacturing complex forms. Whether because of the material formulation, the long cure periods, the high temperatures, excessive pressure requirements or the post-forming operations, none of the available plastic foams proved practical for these complex forms.

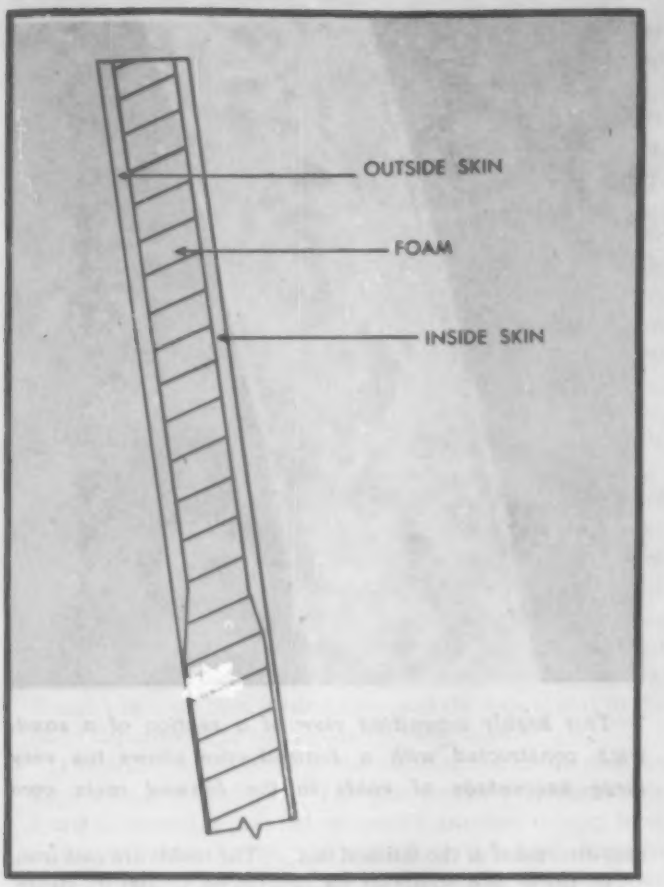
Proceeding on the premise that a plastic foam was required which could be easily compounded and handled, and which was capable of being molded into complex shapes in a simple operation, our Research Laboratory embarked on a program of development directed toward the production of just such a formulation. The idea was to make a plastic foam structure from a pourable mixture of components in much the same manner that a woman makes a cake from a batter. But our "cake" had to bake in 15 to 20 minutes' time, had to be able to conform to any type of monocoque surface, had to be baked at very low oven temperatures, and was not to be restricted in size up to 6 ft. in height regardless of base measurements.

After devising and investigating approximately 200 various formulations, including foams made from phenol- and urea-formaldehydes, polystyrenes, cellulosic resins, allyl resins, vinyls and methacrylates, three compounds were produced which met the requirements. Further laboratory work was then needed to develop the flexibility of mechanical, chemical and electrical properties, variations in density, and those final alterations which would render the plastic foam applicable to the manufacture of any one particular item. That the formulations and processes have proved successful is indicated by the production at our plant during the past year of plastic foam structural units. Plastic foam in irregular shapes and sizes is a well-established fact.

The process of manufacture of a plastic foam structure is well illustrated by the production of a nose for a fast fighter plane. For this item, the prime requisites were a core specific gravity of 0.30, excellent weathering and electrical characteristics, and resistance to destruction caused by gun blast concussion. The plastic foam was to be enclosed between inner and outer laminated skins. All requirements were very satisfactorily met. Of particular interest was the ability of the material to be manufactured within the specific gravity and thickness tolerances allowed.

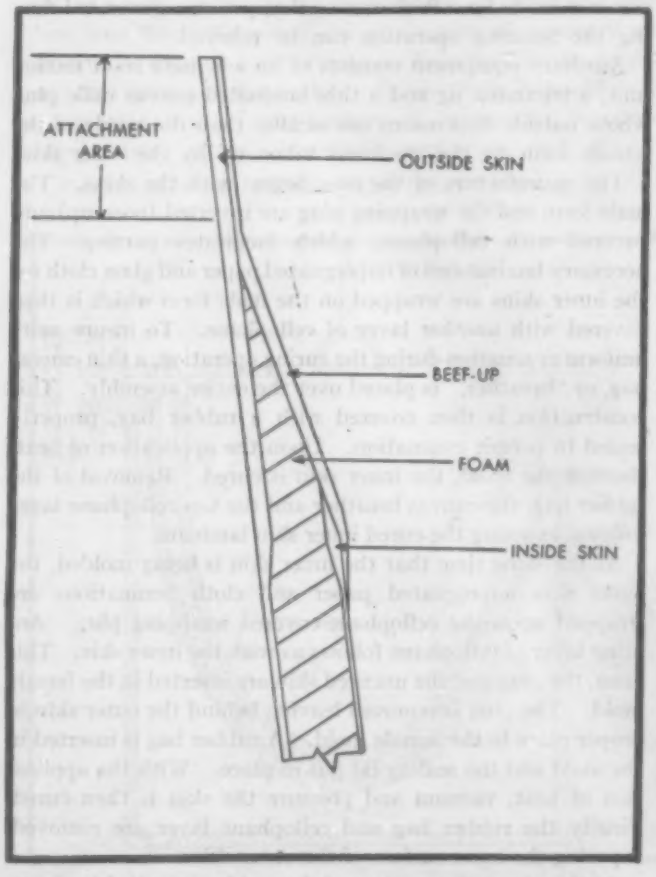
The equipment required for the manufacture of these noses consists of a male and female mold, the contours of the male form being an exact duplication of the female minus the thick-

* Chief engineer, Virginia-Lincoln Corp.

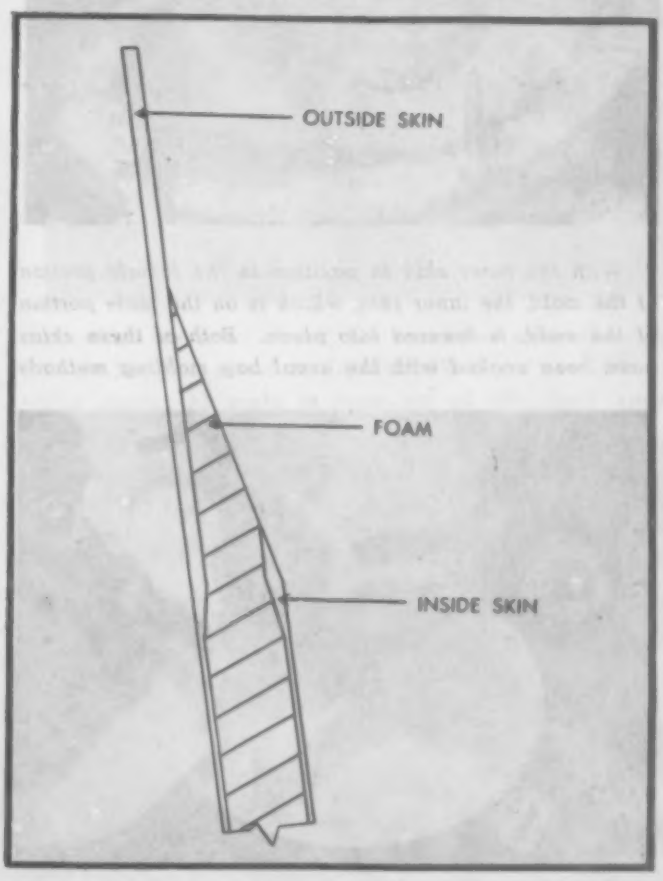


3—*Crushing strength of foamed structure as shown here is not sufficient to insure satisfactory attachment of nose*

4—*Areas of the inner skin which are close to the attachment area are cut away after which the core is scarfed*



6—*In the next step, beef-up skin is added to structure*

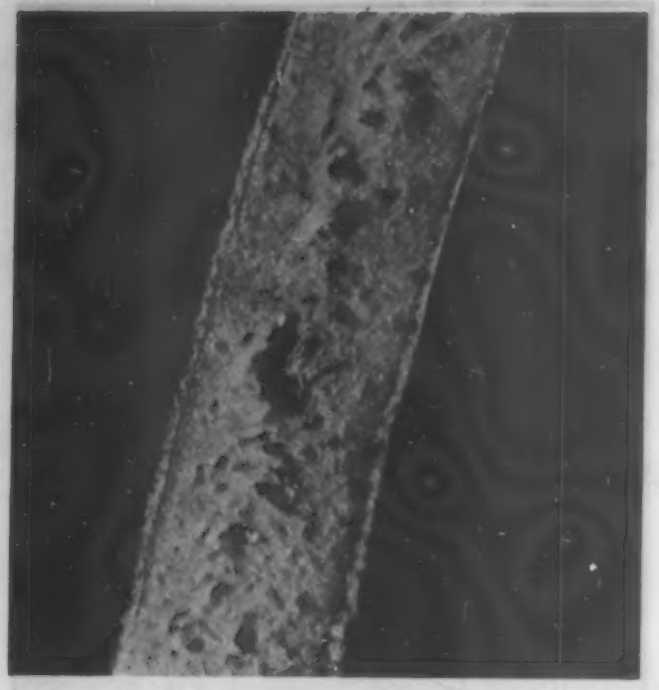


5—*Cross-section after core has been scarfed (Fig. 4)*

8—Laying up the resin impregnated glass cloth on the male portion of the mold for the inner skin of the dome

9—With the outer skin in position in the female portion of the mold, the inner skin, which is on the male portion of the mold, is lowered into place. Both of these skins have been cooked with the usual bag molding methods

10—Foaming agents must be carefully mixed with core resin



7—This highly magnified view of a section of a sandwich constructed with a foamed core shows the very large percentage of voids in the foamed resin core

ness dimension of the finished nose. The molds are cast iron, 3/4 in. thick, and equipped for heating up to 100 lb. steam. Surfaces are highly polished. A spacing mechanism for locating the male form in the female form is provided as is a clamping arrangement for locking the molds together. Provision was made for a flash area so that pressure generated during the foaming operation can be relieved.

Auxiliary equipment consists of an adequate resin mixing unit, a trimming jig and a thin laminated canvas male plug whose outside dimensions are smaller than the inside of the female form by the thickness taken up by the outer skin.

The manufacture of the nose begins with the skins. The male form and the wrapping plug are inverted (nose-up) and covered with cellophane, which facilitates parting. The necessary laminations of impregnated paper and glass cloth for the inner skins are wrapped on the male form which is then covered with another layer of cellophane. To insure more uniform evacuation during the curing operation, a thin canvas bag, or "breather," is placed over the entire assembly. This construction is then covered with a rubber bag, properly sealed to permit evacuation. Upon the application of heat, through the mold, the inner skin is cured. Removal of the rubber bag, the canvas breather and the top cellophane layer follows, exposing the cured inner skin laminate.

At the same time that the inner skin is being molded, the outer skin impregnated paper and cloth laminations are wrapped upon the cellophane-covered wrapping plug. Another layer of cellophane follows as with the inner skin. This done, the plug and the uncured skin are inserted in the female mold. The plug is removed leaving behind the outer skin in proper place in the female mold. A rubber bag is inserted in the mold and the sealing lid put in place. With the application of heat, vacuum and pressure the skin is then cured. Finally the rubber bag and cellophane layer are removed, exposing the inner surface of the outer skin.

At this stage, the portions of the mold are readied for foaming. The male form is elevated with a chain hoist and placed

in the "nose-down" position above the female form where, by rapid lowering, it can properly locate itself in the female form for the foaming operation.

The various components of the foam resin mixture are weighed out and cooled to a safe operating temperature. Next, they are carefully combined in a Hobart-type mixer. Within 5 minutes' time, a homogeneous mixture results.

With the molds ready, the foam mixture is poured into the female portion. Guided by the spacing mechanism, the male mold is lowered into position and the molds locked together. Within 3 minutes of the application of heat, the excess foam material starts escaping via the flash areas. Fifteen minutes later the curing is complete and the molds are cooled.

After the male mold has been raised, the foamed nose, which is securely bonded to its skins, is lifted from the female form and sent to the finishing area for trimming and painting. Due to the fact that this particular part requires a reinforced area for attachment to the airplane fuselage, portions of the foam and inner skin must be trimmed away and the inner surface of the outer skin exposed. "Beef-up," or reinforcing material, which consists of uncured impregnated glass fabric, is bonded so as to cover the section of foam which has been exposed (Figs. 4, 5, 6). Curing of this material follows. Rough edges are then sanded away and the nose is sent to the paint department to be prepared for shipment.

The principles outlined in the manufacture of this nose are applicable to other items. The same general procedures were found to prevail in parts where specific gravities ranging from 0.20 to 0.80 were desired, where bearing and flexural strengths were stressed, where surface areas of 50 sq. ft. and more were required. The desired properties were obtained primarily by foam formula variations; secondly by changes in equipment.

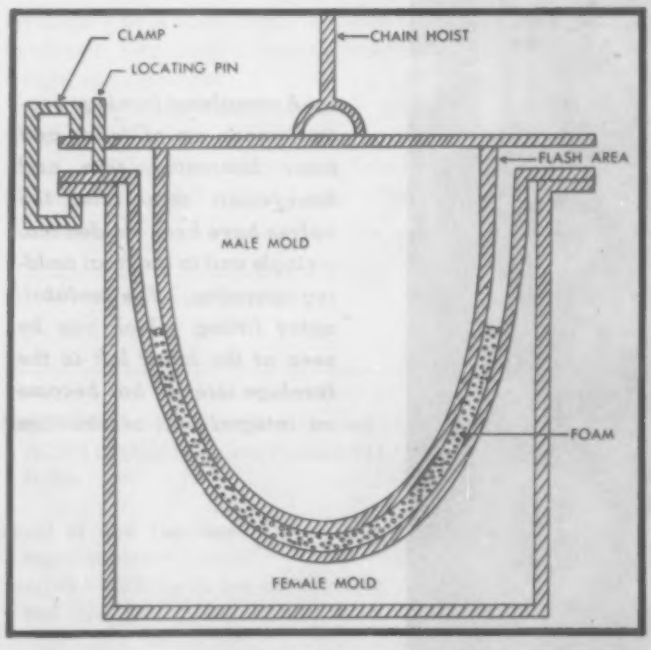
Whereas the work of our company both in the development of the plastic foam and the manufacture of structural items has been directed toward the production of necessary war materials, there is every reason to believe that the process will find many postwar outlets. For example, it should prove practicable in the manufacture of low-weight furniture, refrigerators, stoves, household insulation and aircraft.

Credits—Material: Valenite. Core resin: Laminac.

11—After the core resin has been thoroughly mixed, it is poured into the cavity made by the outer skin

12—With the mold closed, the inner and outer skins are in the position shown in Fig. 14. Heat and catalytic action cause the resin to foam out at the flash space

13—The foamed resin sets after curing and thereby welds together the inner and outer skins of the sandwich



14—A section drawing of the mold in closed position with the foam beginning to fill the space between skins

Honeycomb core in sandwich structure

by LEONARD S. MEYER and JOHN C. CASE*

CELLULAR all-laminate honeycomb materials, developed as a result of resin research and application technique experimentation in our laboratories, offer another solution to the problem of replacing wooden cores in laminated sandwich construction with low-density synthetic core materials. The ease with which these cellular all-laminate honeycomb materials could be produced, the identity of their composition with that of the laminate skins, and the possibility of production in any weight and strength up to that of solid laminate, led Wright Field personnel to request our plastics division to undertake the experimental production of all-laminate fuselage sections and to deliver a number of these for test purposes. Under the resultant contract, a complete BT-15 fuselage rear section was constructed of resin-glass cloth laminate employing no wooden inserts.

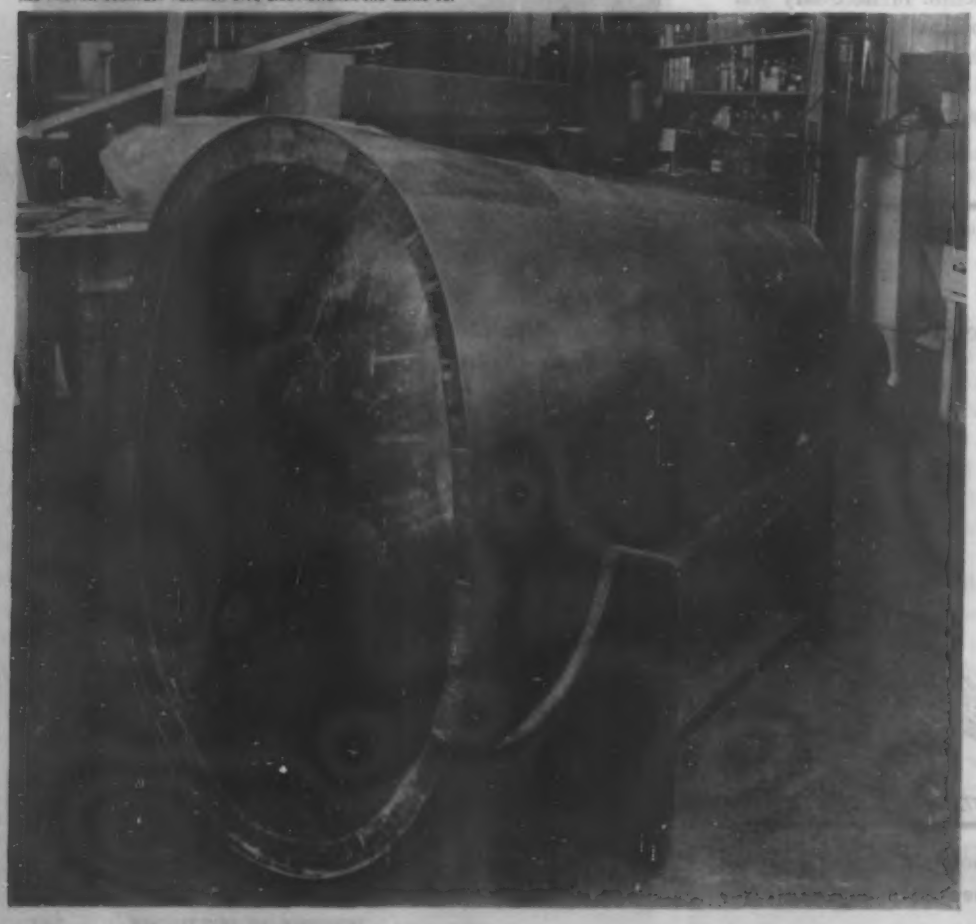
The use of metal was limited to fittings necessary for attachment to the remainder of the airplane, and such rivets or bolts as were required for their assembly—this much being dictated by the original design of the metal plane.

To date tests of this construction have been limited to complete static and ground firing tests, and all have been satisfactory. Additional fuselage sections for flight test and study are under construction.

This BT-15 rear fuselage section has now been produced in four types of construction—aluminum alloy, wood, glass-laminate and wood combination, and finally, the all-laminate makeup. Interesting comparison of static test results for these four constructions are shown in Table I.

* Associate director of engineering research and research engineer, respectively, Plaskon Div., Libbey-Owens-Ford Glass Co.,

ALL PHOTOS, COURTESY PLASKON DIV., LIBBY-OWENS-FORD GLASS CO.



1—A completed fuselage section, made up of inner and outer laminated skin and honeycomb core, after the halves have been welded into a single unit in the final molding operation. The prefabricated fitting, which can be seen at the lower left in the fuselage interior, has become an integral part of structure

Materials of construction

The complete fuselage section was built of urea-formaldehyde glass cloth laminate, except for the rivets, tail wheel and stabilizer attachment fittings, and front attachment washers. The total weight of metal involved was 3.3 lb., and the weight of the complete fuselage section was 75 pounds. Four types of the laminate construction were employed:

1. Solid glass cloth laminate for sandwich skins, rear bulkhead and front band for attachment of fairings.
2. Low-density honeycomb core weighing 9 lb./cu. ft., used in $^3/_8$-in. thicknesses for the bulk of sandwich core and for the core in the stiffening bands.
3. Heavier honeycomb core used under the stabilizer attachment fittings only, to withstand rivet pressure.
4. Tubular higher density core employed under the rear center stiffening band and for two longitudinal core stringers about 3 in. wide extending from the front attachment fittings to the rear bulkhead.

Conforming to the design tradition of using previously determined physical constants combined with data on anticipated stresses, constants for the types of construction to be employed were first determined on sample products. Data obtained and safety factors employed are shown in Table II.

The fuselage section was fabricated in two halves and then assembled. This was done not because it was necessarily the best procedure but because molds for the halves were available from earlier work at Wright Field, whereas a full mold was not available.

Individual components of core materials, rear bulkhead, front and rear stabilizing ring cores, rear reinforcement spars for tail wheel assembly attachment, and three front attachment fittings, were prefabricated of laminate, then incorporated in one operation into the complete half structure.

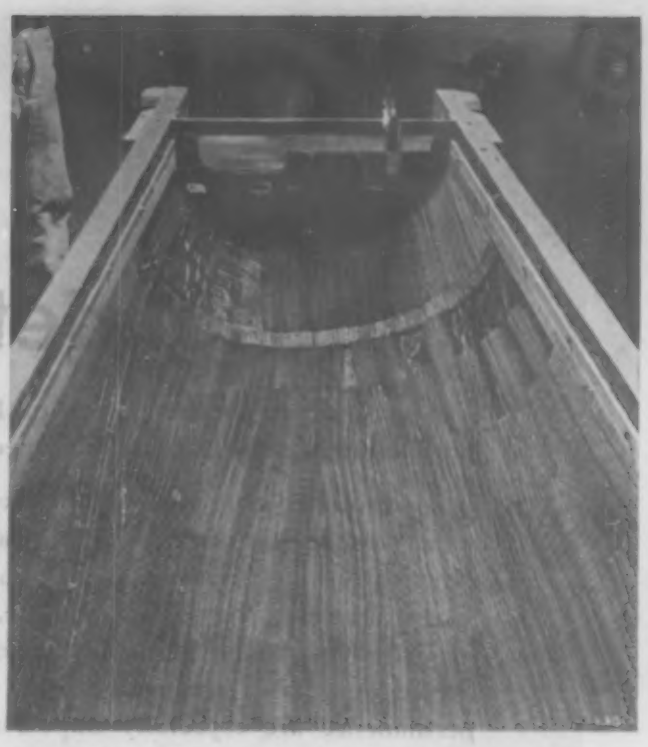
In producing each fuselage half section, a simple procedure giving consistently satisfactory results was followed:

1. Lubricate the mold with thinly applied solution of Vegin A3.
2. Apply the outer skin, pre-impregnated and laid up fabric layers (7 ply).
3. Place all core materials.
4. Place prefabricated components—beams, bulkheads, attachment fittings and rear and front frame cores.
5. Apply inner skin (mostly 6 ply). Gradation of thickness was employed in some areas to meet anticipated stresses.
6. Cover complete assembly with a thin polyvinyl alcohol blanket. Seal edges of blanket to mold above the "lay-up."
7. Apply vacuum between blanket and mold, thus putting pressure on the lay-up. The blanket is allowed sufficient excess so as to mold firmly around all fittings.
8. Cure or weld the lay-up into one complete structure by means of oven-baking.

It is believed that the outstanding strength-weight ratio of this all-laminate construction, combined with its smooth exterior surface and extreme stiffness, will be of interest to aircraft engineers.

Questions raised will involve fabrication methods. It is believed that many advantages can be demonstrated through the use of this new structural material in judicious combination with metal, and that the following enumerated advantages make it of great potential value:

1. *Prefabrication possible*—As in all-metal construction, component parts may be readily produced in widely separated plants and finally assembled as a complete structure.
2. *Mass production methods feasible*—Sandwich core material may be readily corrugated and assembled, and cheaply produced with semi-automatic machinery, in any desired weight and thickness.
3. *Results consistently uniform*—Easy cure of the resin—whether enclosed or exposed to air—coupled with its "tackiness," enables core, skins and subassemblies to be easily placed and held in place, and (*Please turn to page 192*)



2—The mold for half a fuselage with the outer skin, half of the rear bulkhead preform, the honeycomb core and the tubular higher density core in place

TABLE I.—STATIC TEST RESULTS

Construction material	*Weight*	*Effect of 100 percent of design loads*	*Design load at failure (tail wheel side load)*	*Strength-weight ratio*
	pounds		*percent*	
Aluminum alloy	70	No failure—visible buckling in some cases	105	1.00
Wood and plywood	86	No failure—visible buckling in some cases	110	0.82
Glass cloth laminate with wooden core sandwich construction	78	No failure	180	1.50
All resin-glass cloth laminate sandwich construction	75	No failure	180	1.55

TABLE II.—DESIGN DATA AND SAFETY FACTORS

Construction material	*Properties determined*	*Values recorded*	*Values employed in design*	*Safety factor allowed*
			p.s.i.	*percent*
Solid laminate of "heat-cleaned" ECC-112 glass cloth and Plaskon 911 resin	Edgewise compression	40,000 p.s.i.	20,000	100
	Tension	45,000 p.s.i.	30,000	50
	Bearing	50,000 p.s.i.	30,000	67
	Shear	15,000 p.s.i.	5,000	200
Bond of new laminate to previously cured laminate	Shear	2,000 p.s.i.	1,000	100
Sandwich with 3/8-in. low density core and 7-ply ECC-112 glass cloth faces	Edgewise compression	1,000 lb./in.	Stress data inadequate to determine	
	Flatwise compression	900 lb./in.		
	Tension normal to faces	400 p.s.i.	200	100
Sandwich with 3/8-in. high density core and 7-ply faces	Flatwise compression	1,800 p.s.i.	Stress data inadequate to determine	

Sun Helmets—fighter style

The exceptional characteristics of Plaskon Resin Glue are utilized in the production of sun helmets for armed forces in the tropics.

No ordinary glue will permit the fabrication of helmets that are so light, so strong, so weatherproof. The holding power of Plaskon Resin Glue is practically indestructible. It is highly resistant to the effects of water, even when immersed for periods of time. No mould, fungi or bacteria can attack it. Extremes of heat and cold cannot affect it. In hot, steaming jungles and torrid deserts of tropical zones, these Plaskon Resin Glue features of permanence are especially important.

The rain-shedding helmet at the top is molded in one piece from cork and fabric, glued together by Plaskon resin into one integral unit that cannot delaminate or separate. The fair-weather helmet at the bottom also is molded in one piece, from mesh-weave fabric that has been coated with Plaskon resin. Rigidity is given both these helmets by the strength of the resin glue after molding.

This is another illustration of the new gluing and bonding advantages which Plaskon Resin Glue is bringing to a wide range of industries. Wood, paper, fabrics, glass cloth, compositions—almost all kinds of porous materials can be *permanently* bonded together and strengthened with this remarkable product of resin research. Plaskon facilities and experience are available for planning the adaptation of Plaskon resins to your present and future manufacturing and sales plans.

PLASKON DIVISION

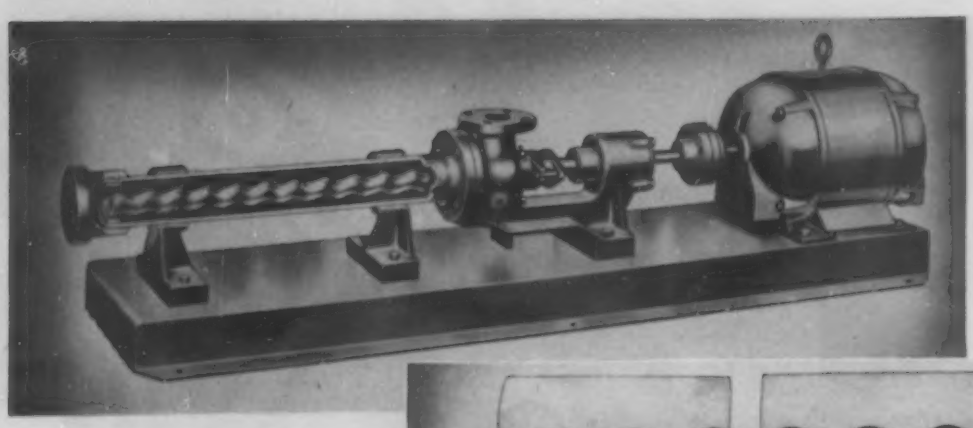
LIBBEY • OWENS • FORD GLASS COMPANY • 2121 SYLVAN AVENUE, TOLEDO 6, OHIO

Canadian Agent: Canadian Industries, Ltd., Montreal, P. Q.

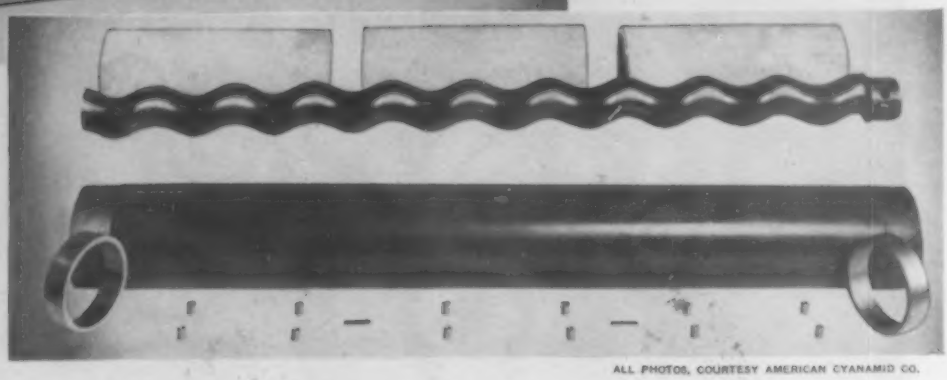
PLASKON

TRADE MARK REGISTERED

• RESIN GLUE •



The problem of "gas blocking" in high-pressure pumps for producing melamine was eliminated by the use of melamine stators. The pump pictured has a section cut away to show rotor and internal construction of the stator



Component parts of the barrel section of multiple-stage pump. The stator is formed from three blocks of melamine (top) which have been bored in order to surround the rotor

ALL PHOTOS, COURTESY AMERICAN CYANAMID CO.

Melamine solves pumping problem

by D. H. W. FELCH*

WHILE it is accepted that machinery made from metal is used in the fabrication of metal products and that kilns built of brick are used for the firing of bricks, the application of plastics to the manufacture of plastics attracts immediate comment. A case in point is the use of melamine in the mechanism of high-pressure pumps which are employed in the production of melamine.

Melamine results from the high-pressure, high-temperature reaction of a cyanamide derivative with solvents. At one stage of this reaction, these volatile solvents must be pumped to a pressure of several hundred pounds per square inch. Pumps capable of pumping against this head are not hard to find. But in the production of melamine the problem is complicated by the fact that the pumps must operate at elevated pressure with these solvents and not "gas block."

* Assistant chief engineer, Calco Chemical Div., American Cyanamid Co.

Samples of the cotton reinforced melamine from which the stator is made. The part (left) has been bored to fit the contours of the rotor for high pressure pump

Most pressure pumps are so designed that the incoming fluid enters enlarged spaces, changes direction or is moved in some other manner so that the liquid, if under high vapor tension, will flash into gas. On the other hand, the majority of conventional pumps, designed for water or non-volatile fluids, cannot rid themselves of this gas. Consequently they become "gas blocked," a condition which cuts down the capacity of the pump since the entrapped compressed gas occupies some part of the normal working spaces of the pump.

Faced with the problem of finding a unit which would combine the desired qualities of both the pressure pump and the conventional pump, our technical staff examined the possibility of using a pump which had been employed in the handling of large quantities of CO_2.

The principle of this pump's operation is very interesting. A single-thread helical screw of long pitch rotates about its longitudinal axis within a matching double-thread helical stator. By reason of this design, fluid fed into the periphery of the rotor at one end is conveyed or screwed along the blank thread of the stator and delivered under pressure at the far end. A fixed close clearance between the rotor and stator is necessary to induce and maintain pressure.

This close clearance immediately creates a lubricating problem which has been solved by the pump company through the use of different materials for the rotor and stator, depending upon the application for which the pump is intended. If lubricating oil is to be pumped, two metals are employed for the rotor and stator. For general purpose pumping, on the other hand, the rotor is constructed of hard steel and the stator of rubber, crude or synthetic. The pumping of solvents such as are used in the production of melamine demands yet another solution. Since the use of rubber is difficult and the application of lubricants im- (*Please turn to page 192*)

14,000 MILES AWAY

Yes, it's 14,000 miles from France to Tokyo! Men, munitions, and supplies must be sent across the seas in ever-increasing numbers, if we are to finish off our final enemy as quickly as possible. Millions of Gaylord Boxes will be used to protect these shipments on the routes to Victory.

It will take *all we've got* to defeat Japan. So, stay on that war job . . . keep on buying War Bonds and keep doing all your country asks.

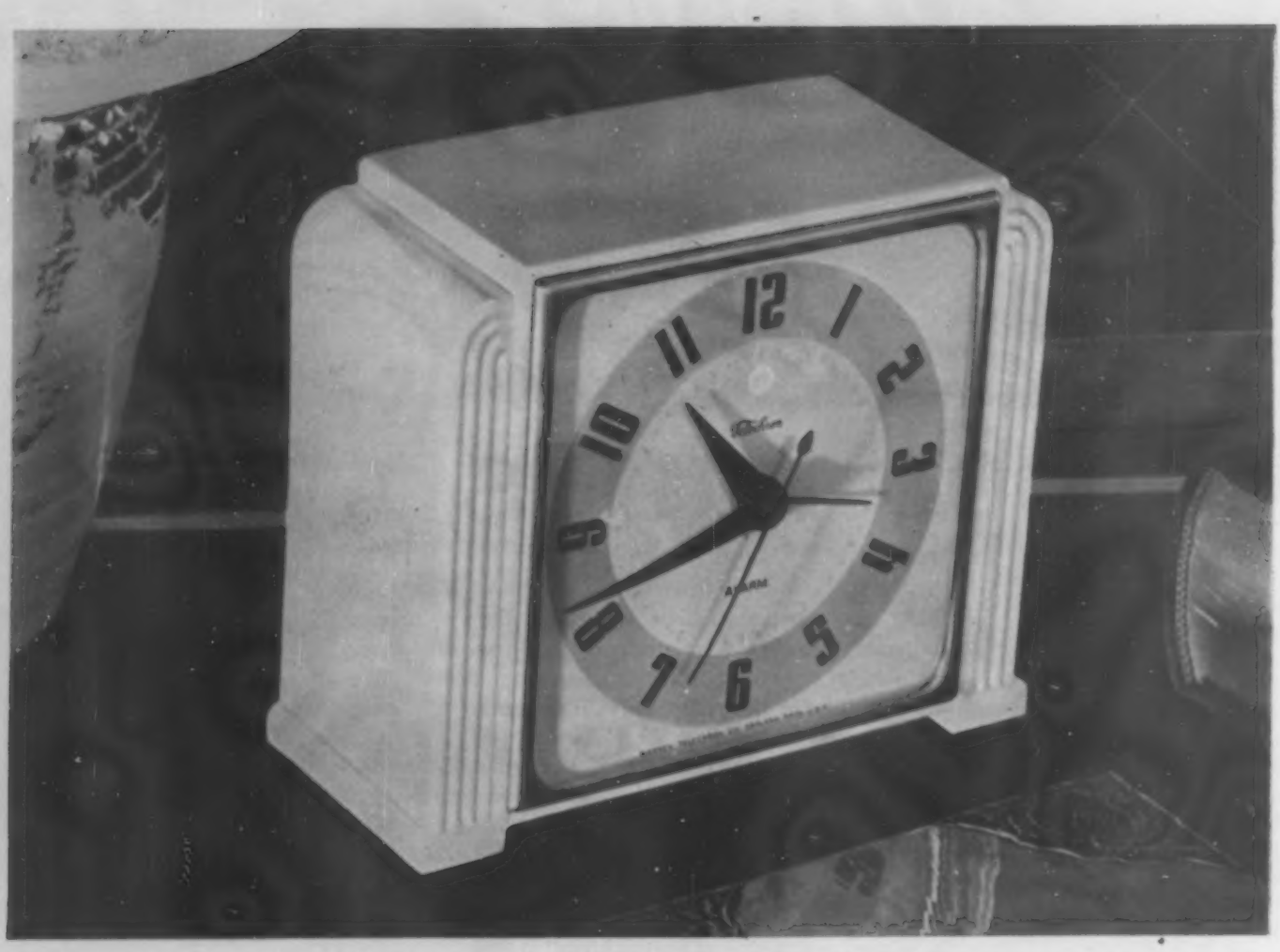
Keep on Buying More and Bigger War Bonds

GAYLORD CONTAINER CORPORATION • General Offices • SAINT LOUIS

KRAFT GROCERY BAGS AND SACKS • KRAFT PAPER AND SPECIALTIES
CORRUGATED AND SOLID FIBRE BOXES • FOLDING CARTONS

New York • Chicago • San Francisco • Atlanta • New Orleans • Jersey City
Seattle • Houston • Indianapolis • Los Angeles • Oakland • Minneapolis
Dallas • Jacksonville • Columbus • Tampa • Fort Worth • Detroit • Des
Moines • Cincinnati • Oklahoma City • Portland • Chattanooga • St. Louis
Greenville • San Antonio • Memphis • Milwaukee • Kansas City • Bogalusa
Weslaco • New Haven • Appleton • Hickory • Greensboro

Beetle ... sells



This Telechron electric alarm clock with ivory BEETLE *case is now being made by Warren Telechron Company and will soon be on sales counters throughout the country. Telechron clock housings are molded by Northern Industrial Chemical Co. and General Electric Plastics Divisions.*

BUTTONS molded of BEETLE appeal to customer, retailer, and manufacturer alike, because of their absolute uniformity and smooth, attractive finish that doesn't crack or craze, chip or peel.

HOUSINGS for barometers, thermometers, and other instruments, withstand wear and abrasion caused by constant handling when molded of smooth, shatter-resistant BEETLE.

All the time!

Customers may be more plentiful than clocks just now, but there's always magic sales appeal to a product housed in BEETLE*. For the plastic, BEETLE, has the charm of color, the pleasantness of texture, the lastingly beautiful finish to create and satisfy customers.

There's also "customer-value" appeal with BEETLE because smart, quality appearance can be achieved on a low-cost, volume production basis to enable your product to compete profitably in the desired price range.

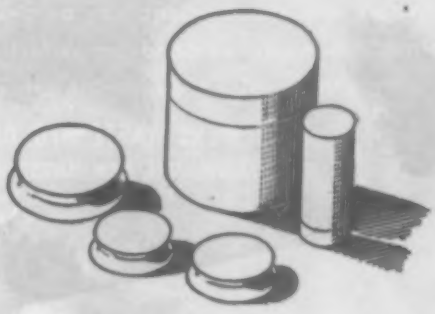
And BEETLE housings give needed protection to clockworks, instruments, radio sets, electric razors, and other mechanisms. For BEETLE is both thermally and electrically insulating. It can be molded to close tolerances of your own requirements.

Information about BEETLE, *the plastic that's all color in all colors* to style your line for modern-day consumer appeal, will be supplied on request.

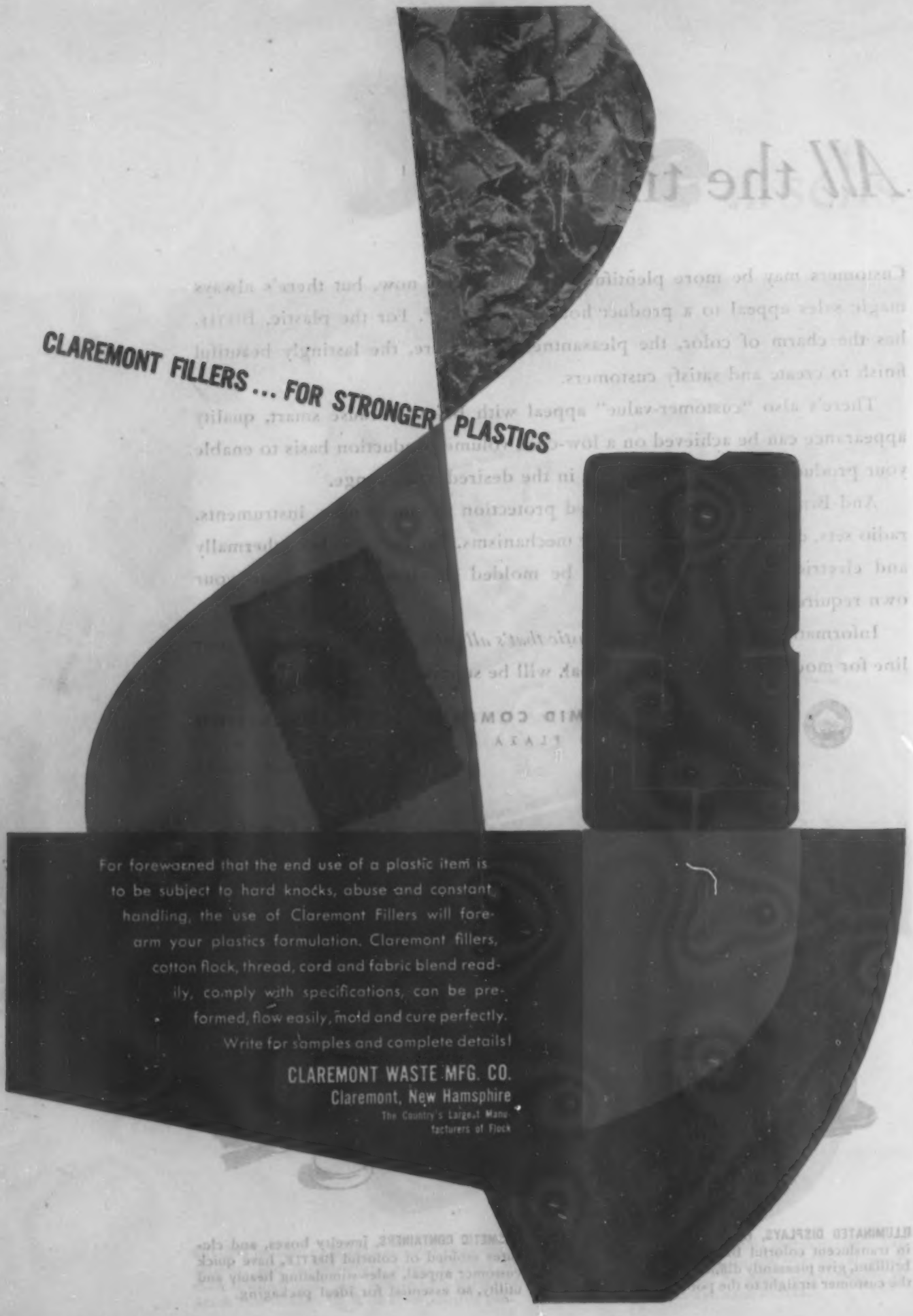
AMERICAN CYANAMID COMPANY · PLASTICS DIVISION
30 ROCKEFELLER PLAZA · NEW YORK 20, N. Y.
*Reg. U. S. Pat. Off.

Beetle · Melmac
Melurac · Laminac · Urac

ILLUMINATED DISPLAYS, trade-marks, and signs in translucent colorful BEETLE are singularly brilliant, give pleasantly diffused light, and lead the customer straight to the point of sale.



COSMETIC CONTAINERS, jewelry boxes, and closures molded of colorful BEETLE, have quick customer appeal, sales-stimulating beauty and utility, so essential for ideal packaging.


CLAREMONT FILLERS ... FOR STRONGER PLASTICS
For forewarned that the end use of a plastic item is to be subject to hard knocks, abuse and constant handling, the use of Claremont Fillers will forearm your plastics formulation. Claremont fillers, cotton flock, thread, cord and fabric blend readily, comply with specifications, can be preformed, flow easily, mold and cure perfectly. Write for samples and complete details!
CLAREMONT WASTE MFG. CO.
Claremont, New Hamsphire
The Country's Largest Manufacturers of Flock

TECHNICAL SECTION

DR. GORDON M. KLINE, Technical Editor

Impact strength of plastic materials at various temperatures*

by D. A. SHINN†

IN this investigation Izod and Charpy impact data were determined for several thermoplastic and thermosetting plastic materials, especially to show the effect on the impact properties of temperature variations within the range of −67° to 158° F., which is that encountered in the normal operation of aircraft. Additional data were obtained relative to notched and unnotched specimens, edgewise and flatwise tests, directional effects, laminated specimen tests, as well as the effect of moisture content.

In general, an increase in temperature increases the impact energy absorption, but some materials exhibit practically no change due to temperature variation. There is no definite correlation between the Izod and Charpy test, but in general a material giving relatively good values as measured by the Izod test would be rated approximately the same by the Charpy test, both in the relative amounts of impact energy absorbed and in the notch sensitivity when expressed as the ratio of notched to unnotched impact values.

No relationship was established between the impact strength and either the tensile or flexure properties. Comparisons are made between the impact energy and the energy absorbed during a bend test, but the data have no direct correlation because of the differences in the effects of paper, cloth and wood fillers on the impact properties.

Materials

Several types of unfilled thermoplastic and filled and unfilled thermosetting plastic sheets and molded materials as well as resin-impregnated compressed laminated wood panels were tested. Table I lists these materials, their specific gravity and other pertinent data. Some of the materials were commercially available and were, therefore, procured in accordance with specifications, while others were experimental in nature. In so far as possible, all tests were conducted on $^1/_8$-in.-thick sheet, with the exception of a few tests made on sheets of $^1/_{16}$, $^1/_4$ and $^3/_{16}$ in. thickness, of the same composition as the $^1/_8$-in.-thick material listed in Table I, to determine any effects of sheet thickness.

Test procedure

Impact tests on standard notched and unnotched specimens were made with a portable combination Izod-Charpy Impact Tester designed especially for plastic materials. It was equipped with three pendulum-hammers with energy-absorbing capacities of 25, 50 and 100 in.-lb. for either type of test. Two removable vises were provided for support of the specimen, depending on the type used. All dimensions and weights of the tester conformed to the requirements of the American Society for Testing Materials.[1] The portable combination tester is shown in Fig. 1.

Before the actual testing was undertaken, each pendulum was checked for velocity at the moment of impact and for the distance from the point of support to the center of percussion. The velocity was 11.3 ft. per sec. in all cases. Some difficulty was encountered in obtaining a zero energy reading with a free swing of the pendulum because of the bearing friction and friction in the energy-recording pointer and the various weights of the pendulums. This condition could not be eliminated without a redesign of the machine. However, the

[1] "A.S.T.M. Standards on Plastics," Tentative Methods of Tests for Impact Resistance of Plastics and Electrical Insulating Materials, D 256–41 T.

1—Impact tests on standard notched and unnotched specimens were made with this portable combination Izod-Charpy impact tester designed for plastic materials

* Air Corps Technical report No. 5012, August 9, 1943.
† Materials Laboratory, Army Air Forces, Wright Field.

error was slight, being in no case over a half division or 2 percent, well within the variation of impact results. As far as possible, hammers were not interchanged on the same material.

It is recognized that there are several errors inherent in this type of impact testing, but since the primary objective of this investigation was to determine the relative impact values of the several plastics, the errors will only be mentioned. The slight errors in the machine itself have already been noted. Other factors peculiar to this type of impact testing are: 1) the broken-half error, in which kinetic energy is transferred from the pendulum to the broken half, or halves in the case of the Charpy test; 2) the shearing or tearing error, which is the energy consumed in pulling the two halves of the specimen apart after the initial crack has appeared; and 3) the friction between the tup and the broken half.

Several materials could not be procured in thicknesses of 0.5 in. or greater, and specimens from them, therefore, had to be built up of several laminations in order to obtain the required thickness. Two methods of holding the laminations together were used. The first method utilized rubber bands to hold the pieces until they had been aligned and clamped in the vise, after which the rubber band was removed and the specimen fractured while unbound. The second method utilized a flush aluminum rivet at each end of the specimen which was not removed before fracture. Both methods were used on several different materials with no significant differences, so the remaining tests were made on the unbound specimens as they entailed less labor in fabrication. Sheet of 1/16 in. thickness was the thinnest tested in this manner. Specimens of the laminated or built-up type could only be notched on the

TABLE I.—DESCRIPTION OF PLASTICS USED IN IMPACT TESTS

Material[a]	*Specific gravity*	*Material description*
Methyl methacrylate	1.18	Cast transparent 1/2-in.-thick sheet, water white; U. S. Army Spec. 94-12014-B
Cellulose acetate	1.28	Experimental 1/2-in.-thick sheet; purchased on Army Air Forces Specification No. 12025-B; Rockwell M 72-75
Cellulose acetate, soft	1.28	Color pigment added; 1/2-in.-thick sheet; Rockwell M 65-68
Cellulose acetate, hard	1.30	Color pigment added; 1/2-in.-thick sheet; Rockwell M 79-82
Cellulose acetate butyrate, soft	1.16	Color pigment added; 1/2-in.-thick sheet; Rockwell M 51-54
Cellulose acetate butyrate, hard	1.27	Color pigment added; 1/2-in.-thick sheet; Rockwell M 67-70
Vinyl chloride acetate	1.35	Transparent sheet; purplish cast; 1/2-in.-thick sheet
Polystyrene	1.05	Water white, unpolished; 1/2-in.-thick sheet
Cast phenolic	1.36	Cast phenol-formaldehyde; 1/4-in.-thick translucent amber sheet
Ethyl cellulose	..	Color added; 0.5 by 0.5-in. bar
Aniline-formaldehyde, 1	1.20	Unplasticized; thermosetting; translucent reddish-brown; 1/2-in.-thick sheet
Aniline-formaldehyde, 2	1.28	Plasticized; thermosetting; translucent reddish-brown; 1/2-in.-thick sheet
Allyl derivative resin	1.31	Transparent cast thermosetting resin, 1/2-in.-thick sheet
Bagasse	1.43	Bagasse plastic and bagasse dry-shredded fiber (with 40 percent phenolic resin after curing)
Cotton-fiber, phenolic	1.30–1.40	Combed and carded cotton fiber laminate impregnated with a phenolic resin
Wood-pulp, phenolic, 3, 4, 5	..	Wood pulp impregnated with phenolic resin and molded
Paper phenolic laminate (XX)	1.34	Purchased on U. S. Army Specification 71-481, Grade XX (superseded by Federal Specification HH-P-256); resin content 50 percent; 1/2-in.-thick sheet
Fine-fabric phenolic laminate (L)	1.34	Purchased as above; grade L fine-weave cotton fabric of 8 oz. per sq. yd. or less; 1/2-in.-thick sheet
Coarse-fabric phenolic laminate (C)	1.34	Purchased as above; grade C coarse-weave cotton fabric exceeding 8 oz. per sq. yd.; 1/2-in.-thick sheet
Glass-cotton cloth phenolic laminate	1.64	Alternate layers of cross-laminated glass cloth and cotton cloth impregnated with phenolic resin; 1/4-in.-thick sheet
High-strength-paper phenolic laminate	1.39	Cross-laminated high-strength-paper impregnated with 35 percent phenolic resin; medium pressure; 1/2-in.-thick sheet
Muslin allyl laminate	1.36	Laminated impregnated muslin; low pressure, 1/2-in.-thick sheet
Duck allyl laminate	1.35	Laminated impregnated 8 oz. duck; low pressure, 1/2-in.-thick sheet
Kraft-paper allyl laminate	1.38	Laminated impregnated paper; low pressure, 1/2-in.-thick sheet
Hurlbut-paper allyl laminate	1.38	Laminated impregnated paper; low pressure, 1/2-in.-thick sheet
Glass-cloth allyl laminate	1.66	Laminated impregnated Fiberglas; low pressure, 1/2-in.-thick sheet
Lignin laminate	1.39	Fibrous cellulose impregnated with thermoplastic lignin resin; both obtained from wood; 1/2-in.-thick sheet
Lignin phenolic-faced laminate	1.39	As above, but with phenolic-impregnated faces
Cotton-cloth urea laminate	1.22	Laminated duck impregnated with urea resin; 1/2-in.-thick sheet
Compressed maple, phenolic, 6	1.31	Laminated, compressed phenolic-impregnated maple; 23 percent alcohol-soluble resin
Compressed maple, phenolic, 7	1.23	Laminated, compressed, phenolic-impregnated maple; 12 percent alcohol-soluble resin
Compressed birch, phenolic, 8	1.22	Laminated, compressed, phenolic-impregnated birch; water-soluble resin
Compressed maple, phenolic, 9	1.22	Laminated, compressed, phenolic-impregnated maple; alcohol-soluble resin
Compressed birch, phenolic, 10	1.27	Laminated, compressed, phenolic-impregnated birch; alcohol-soluble resin
Compressed ash, phenolic, 11	1.25	Laminated, compressed, phenolic-impregnated ash; alcohol-soluble resin
Compressed poplar, phenolic, 12	1.23	Laminated, compressed, phenolic-impregnated poplar; alcohol-soluble resin
Compressed birch, polyvinyl formal, 13	1.27	Laminated, compressed polyvinyl-formal-impregnated birch
Compressed birch, phenolic, 14	1.28	Laminated, compressed phenolic-impregnated birch; water-soluble resin

[a] Numbers after materials distinguish between various types of similar class materials in figures and tables.

TABLE II.—IZOD IMPACT STRENGTH OF PLASTICS AT 77° F. AND 50 PERCENT RELATIVE HUMIDITY

Direction of specimen[a]	Location of notch	Izod impact strength: Average ft.-lb./in. of notch	Izod impact strength: Range ft.-lb./in. of notch	Maximum deviation percent
	Vinyl chloride acetate			
...	Edgewise[a]	0.53	0.52– 0.53	− 1.9
...	Edgewise[b]	0.53	0.52– 0.53	− 1.9
	Polystyrene			
...	Edgewise	0.22	0.19– 0.24	−13.6
	Cast phenolic			
...	Edgewise[d]	0.57	0.55– 0.60	+ 5.3
	Ethyl cellulose			
...	Edgewise	3.11	2.20– 4.15	+30.6
	Aniline-formaldehyde			
1, ...	Flatwise	0.53	0.47– 0.58	−11.3
1, ...	Edgewise[a]	0.67	0.53– 0.77	−20.8
1, ...	Edgewise[c]	0.47	0.38– 0.55	−19.1
2, ...	Flatwise	0.44	0.25– 0.55	−43.1
	Allyl derivative resin			
...	Flatwise	0.24	0.19– 0.28	−20.8
	Bagasse			
...	Edgewise	0.32	0.25– 0.40	+25.0
	Cotton fiber, phenolic			
...	Edgewise	10.1	9.2 –10.5	− 9.0
	Wood pulp, phenolic			
3, ...	Flatwise	2.10	1.72– 2.55	+21.4
3, ...	Edgewise	0.81	0.70– 0.98	+21.0
4, ...	Flatwise	2.60	1.95– 3.22	−25.0
4, ...	Edgewise	0.93	0.83– 1.00	−10.7
5, ...	Flatwise	4.19	3.50– 5.00	+19.3
5, ...	Edgewise	1.31	1.27– 1.47	+12.2
	Paper phenolic laminate (XX)			
Lengthwise	Flatwise	2.29	1.85– 2.50	−19.2
Lengthwise	Edgewise	0.56	0.55– 0.60	+ 7.1
Crosswise	Flatwise	1.98	1.88– 2.08	± 5.0
Crosswise	Edgewise	0.56	0.55– 0.58	+ 3.6
Lengthwise	Edgewise[a]	0.50	0.48– 0.52	± 4.0
Lengthwise	Edgewise[b]	0.54	0.50– 0.58	± 8.0
	Fine-fabric phenolic laminate (L)			
Lengthwise	Flatwise	4.38	3.84– 4.85	−12.3
Lengthwise	Edgewise	2.22	2.20– 2.24	± 9.0
Crosswise	Flatwise	3.84	3.57– 4.00	− 7.0
Crosswise	Edgewise	1.50	1.48– 1.53	+ 2.0
Lengthwise	Edgewise[a]	2.05	2.03– 2.06	− 0.98
Lengthwise	Edgewise[b]	2.17	2.16– 2.18	± 0.46
	Coarse fabric phenolic laminate (C)			
Lengthwise	Flatwise	2.70	2.54– 2.84	− 5.9
Lengthwise	Edgewise	1.87	1.77– 1.97	± 5.3
Crosswise	Flatwise	2.91	2.67– 3.20	+10.0
Crosswise	Edgewise	1.47	1.40– 1.53	− 4.8
Lengthwise	Edgewise[a]	2.29	2.20– 2.37	− 3.9
Lengthwise	Edgewise[b]	2.02	1.99– 2.08	+ 3.0
	Glass-cotton cloth phenolic laminate			
Lengthwise	Edgewise	21.3	19.3 –22.3	9.4
	High-strength-paper phenolic laminate			
Lengthwise	Flatwise	3.53	2.98– 4.00	−15.6
Lengthwise	Edgewise	0.56	0.51– 0.59	− 9.0
	Methyl methacrylate			
...	Flatwise	0.45	0.37– 0.50	−17.7
...	Edgewise	0.43	0.32– 0.48	−25.5
...	Edgewise[b]	0.40	0.38– 0.42	± 5.0
...	Edgewise[c]	0.47	0.42– 0.48	−10.6
	Cellulose acetate			
...	Flatwise	1.40	1.08– 1.57	−22.8
...	Edgewise	1.32	1.25– 1.42	+ 7.6
	Cellulose acetate (*continued*)			
...	Edgewise[a]	1.17	0.94– 1.37	−19.6
...	Edgewise[b]	0.92	0.72– 1.04	−21.7
	Cellulose acetate, soft			
...	Edgewise	1.38	1.31– 1.47	+ 6.5
	Cellulose acetate, hard			
...	Edgewise	0.21	0.19– 0.22	− 9.5
	Cellulose acetate butyrate, soft			
...	Edgewise	1.49	1.25– 1.80	+20.6
	Cellulose acetate butyrate, hard			
...	Edgewise	0.64	0.42– 0.80	−34.4
	Muslin allyl laminate			
Lengthwise	Flatwise	2.23	2.05– 2.44	+ 9.4
Lengthwise	Edgewise	1.52	1.21– 1.79	−20.4
	Duck allyl laminate			
Lengthwise	Flatwise	4.17	3.83–4.46	− 8.1
Lengthwise	Edgewise	2.26	2.12–2.43	+ 7.1
	Kraft-paper allyl laminate			
Lengthwise	Flatwise	2.99	2.48– 3.76	+25.7
Lengthwise	Edgewise	0.79	0.75– 0.83	± 5.1
	Hurlbut-paper allyl laminate			
Lengthwise	Flatwise	2.04	1.83– 2.44	+19.6
Lengthwise	Edgewise	0.74	0.67– 0.81	± 9.4
	Glass-cloth allyl laminate			
Lengthwise	Edgewise	24.3	22.7 –25.7	− 6.6
	Lignin laminate			
Lengthwise	Flatwise	1.85	1.75– 2.00	+ 8.1
	Lignin phenolic-faced laminate			
Lengthwise	Flatwise	1.33	1.16– 1.42	−12.8
	Cotton-cloth urea laminate			
Lengthwise	Edgewise	12.4	12.0 –12.8	± 3.2
Crosswise	Edgewise	7.52	7.41– 7.67	+ 2.0
	Compressed maple, high resin, 6			
Lengthwise	Flatwise	6.00	.....	−11.1
Lengthwise	Edgewise	5.10	.....	− 8.4
Crosswise	Flatwise	0.32	.....	+15.6
Crosswise	Edgewise	0.32	.....	−12.5
	Compressed maple, low resin, 7			
Lengthwise	Flatwise	7.70	.....	−22.1
Lengthwise	Edgewise	5.90	.....	+21.3
Crosswise	Flatwise	0.68	.....	−23.5
Crosswise	Edgewise	0.43	.....	+20.9
	Compressed birch, phenolic, 8			
Lengthwise	Flatwise	3.11	2.75– 3.55	+14.1
Lengthwise	Edgewise	2.79	2.50– 2.98	−10.4
	Compressed maple, phenolic, 9			
Lengthwise	Flatwise	6.40	5.40– 7.80	+21.9
	Compressed birch, phenolic, 10			
Lengthwise	Flatwise	7.37	6.40– 8.20	−13.1
	Compressed ash, phenolic, 11			
Lengthwise	Flatwise	5.26	4.00– 6.00	−23.9
	Compressed poplar, phenolic, 12			
Lengthwise	Flatwise	2.66	2.40– 3.10	+16.5
	Compressed birch, polyvinyl formal, 1			
Lengthwise	Flatwise	6.4	5.8 – 7.0	+ 9.3
Lengthwise	Edgewise	4.8	3.7 – 5.5	−23.0
	Compressed birch, phenolic, 14			
Lengthwise	Flatwise	6.3	5.0 – 7.8	+24.3
Lengthwise	Edgewise	3.6	2.7 – 4.7	+30.5

[a] Laminated specimen from 1/16-in.-thick sheet. [b] Laminated specimen from 1/8-in.-thick sheet. [c] Laminated specimen from 3/16-in.-thick sheet. [d] Laminated specimen from 1/4-in.-thick sheet. [e] Numbers in left-hand column refer to different types of same class materials; see Table I.

edge, since no bonding medium was used between the layers. Comparative data for the notched Izod and Charpy impact strengths of the various plastics are presented in Table II. All specimens for which no direction is given were thermoplastics in either sheet or bar form and have no directional properties. In the tests conducted on solid versus built-up laminated specimens, no appreciable difference with no definite trend as related to number of laminated pieces was noted.

Specimens for any one type of material were all taken from the same panel or sheet or, in the case of molded material, from a group of samples molded under the same conditions. In all cases in which a specimen is designated as having been tested in the lengthwise direction, the longest dimension of the specimen was parallel to the longest dimension of the original sheet, panel or molded shape. The lengthwise direction was also the direction of greatest strength for material such as laminated compressed wood and paper and cloth laminates. The unfilled plastics had no directional effects so that the lengthwise direction was merely an arbitrary choice.

All impact specimens were 0.5 by 0.5 in. in cross section, either solid or laminated (if from sheet thinner than 0.5 in.), and were either 2.5 or 5 in. long, depending on whether the test was to be the Izod or Charpy type. The notched specimens were notched with a 60° V-notch having a 0.01-in. radius at the apex, using a form cutter of proper contour. The notch was 0.100 in. deep. The Izod and Charpy specimens, both molded and laminated, were the standard type.[1,2]

The Izod impact tests were conducted in accordance with Federal Specification requirements[2] and the Charpy tests in accordance with A.S.T.M. requirements.[1] Both Izod and Charpy specimens for room temperature tests were conditioned at 77° ± 1.8° F. (25° ± 1° C.) and 50 ± 2 percent relative humidity for a minimum of 96 hr. in accordance with the Federal Specification[2] and were tested immediately after removal from the conditioning atmosphere. Specimens at high and low temperatures were left in the cold or hot testing rooms for 24 hr. prior to testing. The temperature variation in these rooms was held to ± 3° F.

[1] "Plastics, Organic, General Specifications (Methods of Tests)," Federal Specification L-P-406 (Dec. 9, 1942).

TABLE III. EFFECT OF MOISTURE CONTENT ON THE IZOD IMPACT STRENGTH OF PLASTICS

Material[a]	*Izod impact strength after exposure to:*		
	Immersion in water for 24 hr.	*77° F. and 50 percent R.H. for 96 hr.*	*160° F. for 24 hr.*
	ft.-lb./in. of notch	*ft.-lb./in. of notch*	*ft.-lb./in. of notch*
Methyl methacrylate	0.51	0.45	0.50
Cellulose acetate	2.1	1.40	0.69
Polystyrene	0.24	0.22	0.24
Vinyl chloride acetate	0.51	0.53	..
Cast phenolic	..	0.57	0.55
Paper phenolic laminate (XX)	2.3	2.3	1.8
Fine-fabric phenolic laminate (L)	4.8	4.4	4.6
Coarse-fabric phenolic laminate (C)	3.9	2.7	3.0
Compressed maple, low resin, 6	7.9	7.7	7.5
Compressed maple, high resin, 7	7.1	6.0	6.6

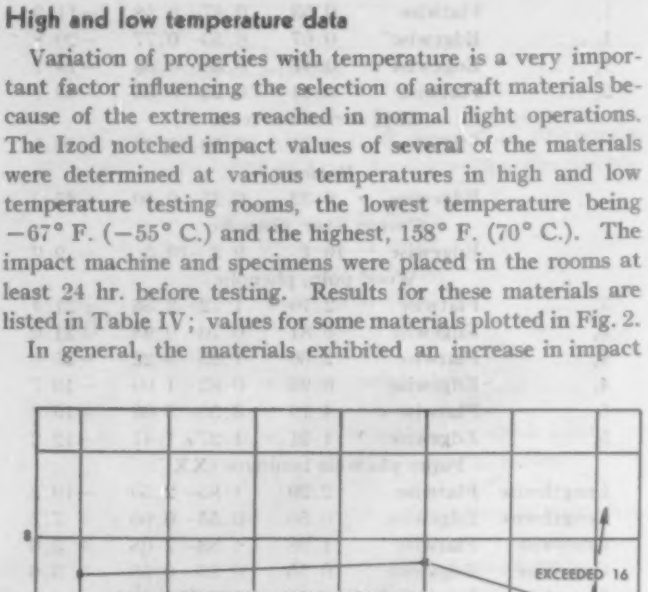
[a] Five specimens of each material notched flatwise were tested at 77° F. The specimens exposed to 160° F. were cooled to 77° F. in a desiccator prior to test.

A few materials were tested to determine to what extent moisture content influenced the Izod notched impact value by heating some specimens at 158° F. for 24 hr. and by soaking others in distilled water for 24 hr. at room temperature. The heated specimens were tested after they had been cooled to room temperature in a desiccator at approximately zero relative humidity and the soaked specimens were tested immediately after removal from the water. The results of these tests are listed in Table III in which it will be noted that a definite increase with increase in moisture content is obtained for cellulose acetate. The remaining materials exhibited considerably less variation, probably because of their greater resistance to water absorption. The vinyl chloride acetate and cast phenolic plastics, because of insufficient material and low water absorbing qualities, were tested at two conditions.

High and low temperature data

Variation of properties with temperature is a very important factor influencing the selection of aircraft materials because of the extremes reached in normal flight operations. The Izod notched impact values of several of the materials were determined at various temperatures in high and low temperature testing rooms, the lowest temperature being −67° F. (−55° C.) and the highest, 158° F. (70° C.). The impact machine and specimens were placed in the rooms at least 24 hr. before testing. Results for these materials are listed in Table IV; values for some materials plotted in Fig. 2.

In general, the materials exhibited an increase in impact



2—Diagram showing the relation of Izod notched impact strength to temperature. All specimens are longitudinal and notched on the face except for those materials marked with a footnote (1) which are notched on edge

TABLE IV.—IZOD IMPACT DATA FOR PLASTIC MATERIALS AT VARIOUS TEMPERATURES

Material[a]	Izod impact strength at									
	Average	−67° F. range	Average	−40° F. range	Average	+77° F. range	Average	+122° F. range	Average	+158° F. range
Methyl methacrylate	0.38	0.27–0.47	0.37	0.28–0.43	0.45	0.37–0.50	0.45	0.40–0.48	0.43	0.42–0.43
Cellulose acetate	0.46	0.37–0.53	0.19	0.17–0.22	1.40	1.08–1.57	1.51	1.37–1.70	2.23	2.08–2.34
Cellulose acetate, soft	0.35	0.24–0.46	..	.....	1.38	1.31–1.47	..	.....	..	.....
Cellulose acetate, hard	0.19	0.17–0.21	..	.....	0.21	0.19–0.22	..	.....	..	.....
Cellulose acetate butyrate, soft	0.44	0.39–0.50	..	.....	1.49	1.25–1.80	..	.....	..	.....
Cellulose acetate butyrate, hard	0.23	0.17–0.30	..	.....	0.64	0.42–0.80	..	.....	..	.....
Vinyl chloride acetate[b]	0.48	0.43–0.50	0.44	0.42–0.46	0.53	0.52–0.53	0.48	0.40–0.51	[d]	.....
Polystyrene	0.22	0.16–0.35	..	.....	0.22	0.19–0.24	..	.....	..	.....
Cast phenolic[c]	0.49	0.37–0.55	0.51	0.50–0.53	0.57	0.55–0.60	0.51	0.43–0.58	0.52	0.42–0.58
Ethyl cellulose	0.40	0.33–0.45	..	.....	3.11	2.20–4.15	..	.....	..	.....
Aniline-formaldehyde, 1	0.43	0.25–0.50	..	.....	0.53	0.47–0.58	..	.....	0.47	0.40–0.52
Aniline-formaldehyde, 2	0.35	0.27–0.42	..	.....	0.44	0.25–0.50	..	.....	0.43	0.33–0.58
Allyl derivative resin	0.33	0.17–0.44	..	.....	0.25	0.19–0.27	..	.....	..	.....
Paper phenolic laminate (XX)	1.86	1.77–1.97	1.82	1.70–1.87	2.29	1.85–2.50	2.19	1.78–2.67	2.46	2.16–2.75
Fine-fabric phenolic laminate (L)	3.13	2.87–3.25	3.14	2.72–3.32	4.38	3.84–4.85	5.09	4.84–5.25	5.30	5.17–5.50
Coarse-fabric phenolic laminate (C)	1.92	1.87–2.04	1.88	1.83–1.95	2.91	2.67–3.20	3.30	2.67–3.77	3.29	3.17–3.50
High-strength paper phenolic laminate	3.40	3.00–3.66	..	.....	3.53	2.98–4.00	..	.....	3.70	2.94–3.96
Muslin allyl laminate	1.44	1.25–1.67	..	.....	2.23	2.05–2.44	..	.....	..	.....
Duck allyl laminate	2.90	2.53–3.22	..	.....	4.17	3.90–4.46	..	.....	..	.....
Kraft-paper allyl laminate	2.20	1.90–3.16	..	.....	2.99	2.48–3.76	..	.....	..	.....
Hurlbut-base allyl laminate	1.50	1.32–1.62	..	.....	2.04	1.83–2.44	..	.....	..	.....
Lignin laminate	1.60	1.42–1.75	..	.....	1.85	1.75–2.00	..	.....	2.37	2.16–2.50
Lignin phenolic-faced laminate	1.14	1.03–1.26	..	.....	1.33	1.16–1.42	..	.....	2.30	2.16–2.44
Compressed maple, high resin, 6	5.43	5.00–5.67	..	.....	6.00	5.33–6.33	..	.....	5.00	4.50–5.67
Compressed maple, low resin, 6	7.58	6.75–8.16	..	.....	7.70	7.33–8.67	..	.....	7.17	6.50–8.00

[a] Five lengthwise specimens notched flatwise were tested for each material at each temperature. Numbers after materials refer to various types of same class materials; see Table I. [b] Laminated from 1/8-in.-thick sheet. [c] Laminated from 1/4-in.-thick sheet. [d] Too soft to fracture at 158° F.

values with an increase in temperature within the limits used, or remained practically unaffected. The two types of compressed impregnated wood, however, possessed higher energy absorbing qualities at room, than at either the high or low temperatures. The decrease at 158° F. is probably caused by the loss in weight of the specimen, which may be moisture and other volatile matter, in the 24-hr. stabilizing period prior to testing.

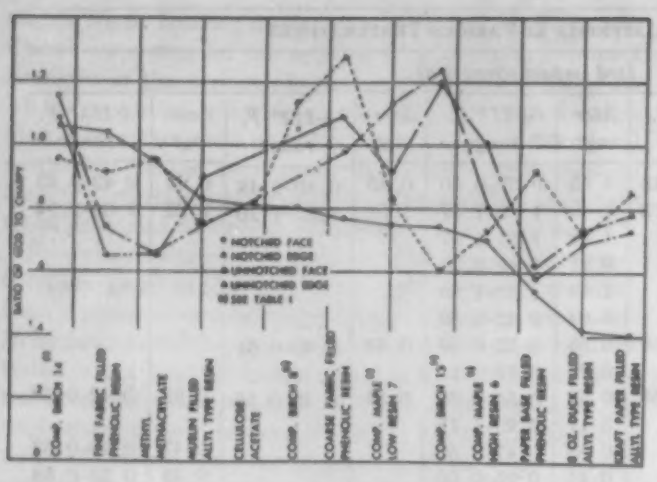
No method of humidity control for the high temperature room was available, resulting in a relative humidity of approximately 10 percent after heating the air from room temperature to 158° F. with no addition of moisture. Consequently, the materials lost some weight before they reached an equilibrium temperature condition. The decrease in the impact strength at −67° F. probably resulted from the increased brittleness and notch sensitivity of the impregnated phenolic resin and also trapped frozen water.

The impact strength of vinyl chloride acetate, which remained practically constant at all temperatures up to and including 122° F. and then increased suddenly, could not be determined at 158° F. because of its extreme softness. Softening had not progressed to the point of flow, except under a slight stress, but the specimen absorbed the entire energy capacity of the impact tester and did not fracture. Glass-fabric-filled plastics were not tested at high and low temperatures because no testing apparatus of the necessary capacity was available in the testing rooms.

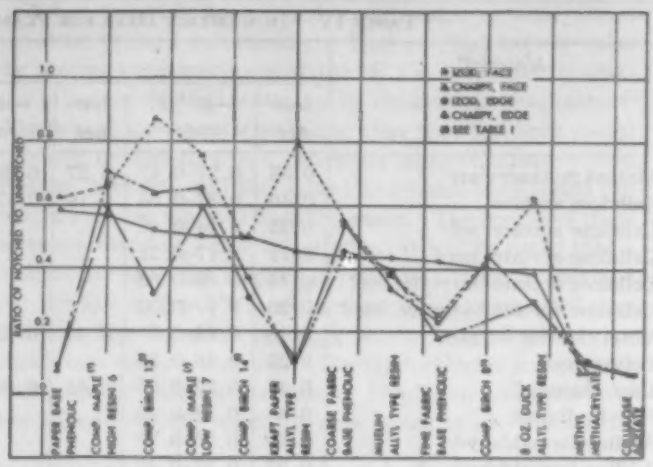
Edgewise versus flatwise tests on specimens

Tests were made to determine if any relationship existed between the results obtained from the Izod and Charpy tests, flatwise and edgewise, and notched and unnotched. These values are listed in Table V and shown graphically in Fig. 3. The materials are arranged in order of decreasing magnitude of the ratio of the notched Izod to notched Charpy impact value when notched on the face. The corresponding ratios notched on the edge and unnotched when struck on the face and edge are plotted for comparison. There appears to be approximately the same relationship between the Izod and Charpy tests made flatwise and edgewise when made on unnotched specimens, but none is apparent between the unnotched and notched specimens or between those notched on the face and those notched on the edge. This condition can be more clearly shown in Fig. 4, in which the ratio of the notched to unnotched impact values are plotted for the materials which have been arranged in order of decreasing magnitude of the Izod values when the specimens are struck on the face. The edge notch effects appear to be approximately the same, but when notched on the face the Charpy test appears in general to indicate somewhat less notch sensitivity than the Izod test, if the notch sensitivity is assumed to be a function of the ratio of the notched to unnotched values. This ratio appears, in general, to be somewhat lower for specimens which are notched on the edge.

In order to show the relation between the face and edge of these laminated materials, Fig. 5 was prepared in which is shown the ratio of the impact value when the specimen is struck on the face to that when struck on the edge. Here again the more definite relationship between Izod and Charpy values for the unnotched specimens is apparent. In this chart the materials are arranged in increasing magnitude of the ratio of the flatwise to edgewise values in the notched Izod test. In general the notched Charpy ratios, although with considerably more variation, follow the increasing trend of the



3—*Ratio of Izod to Charpy impact values of specimens tested at room temperature. All specimens longitudinal*



4—*Plotting of ratio of notched to unnotched impact values on longitudinal specimens tested at room temperature*

Izod values. However, the reverse is true in the unnotched tests, a slight decrease being apparent. The ratio of the flatwise to edgewise impact values in general ranged between 1 and 2, but in the case of the paper base materials, the ratio increased to around 7 for the notched specimens and decreased to 1 or slightly less for the unnotched specimens which were tested.

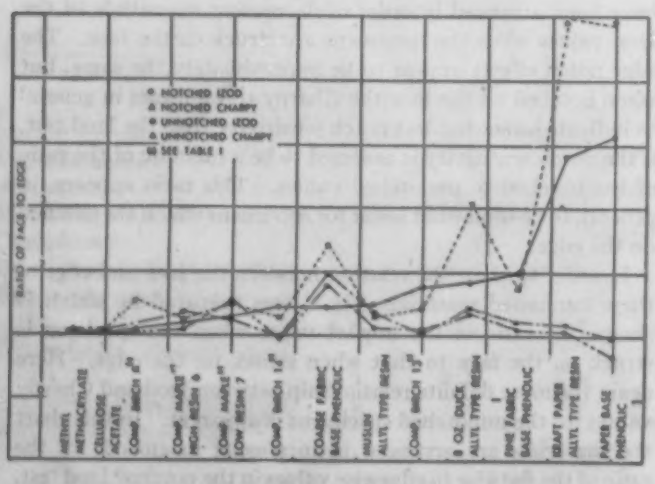
It will also be noticed that the compressed polyvinyl-formal-impregnated wood is the only one of that type which has higher edgewise than flatwise impact values. This condition is probably due to edge compression in manufacture which causes a slight wrinkling of the laminations.

Many variations will be noted in the tables and figures, but in general the data indicate that the compressed impregnated woods, especially of the higher density group, exhibit the best combination of properties of all the materials tested with the possible exception of the glass-cotton-cloth laminate. The paper base materials are highly notch sensitive when notched on the edge, and the unfilled thermoplastics are highly notch sensitive in any direction.

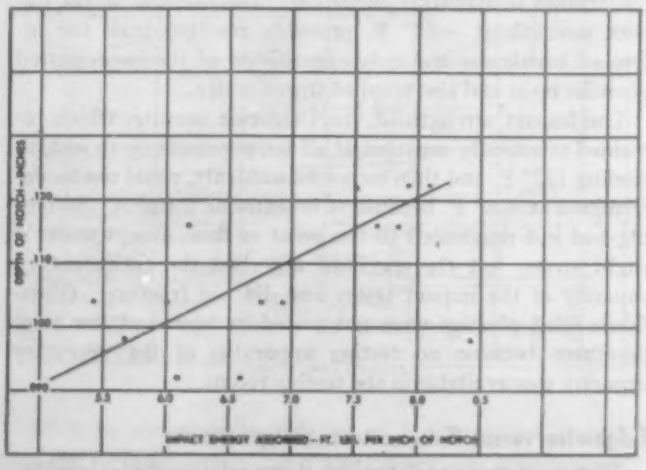
No extensive correlation between the Izod or Charpy impact tests and service life has been accomplished, but it has been found that a low notched impact strength for compressed impregnated wood, as indicated by an Izod test, will be a fairly accurate indication of low strengths when sharp shoulders are present. This correlation was determined from a considerable number of pull tests of propellers. Another indication of the usefulness of the notch test was tests of two pilot seats made from a cloth-filled urea-resin plastic. One seat appeared fairly satisfactory, whereas the other cracked very easily. Notched Izod results for the better one were approximately 100 percent higher. In another case, a clear thermosetting resin occasioned considerable difficulty in tensile testing because of its tendency to fracture at the grips in the tensile test. The notch sensitivity was also indicated by the impact tests. These few tests show that the notched Izod values will indicate when a material is notch sensitive and care must be exercised in treating the material as such when it is used in design applications.

Effect of notch depth

In addition to the impact values obtained on standard notched specimens, Izod tests were made on specimens with several notch depths from commercial Grade XX phenolic laminate and from molded cord-filled phenolic bars of 0.5-in.-square cross section. The distance from the apex of the notch to the opposite face was kept constant at 0.400 ± 0.002 in. and the notch depth was varied by varying the total thickness of the specimen. Three notch depths, the standard 0.100 in. and 0.090 and 0.080 in., were used for the Grade XX phenolic laminate. No significant differences were found in the results obtained from these tests, the impact values being 2.29



5—*Diagram showing relation of face to edge impact values. Specimens tested longitudinally at room temperature*

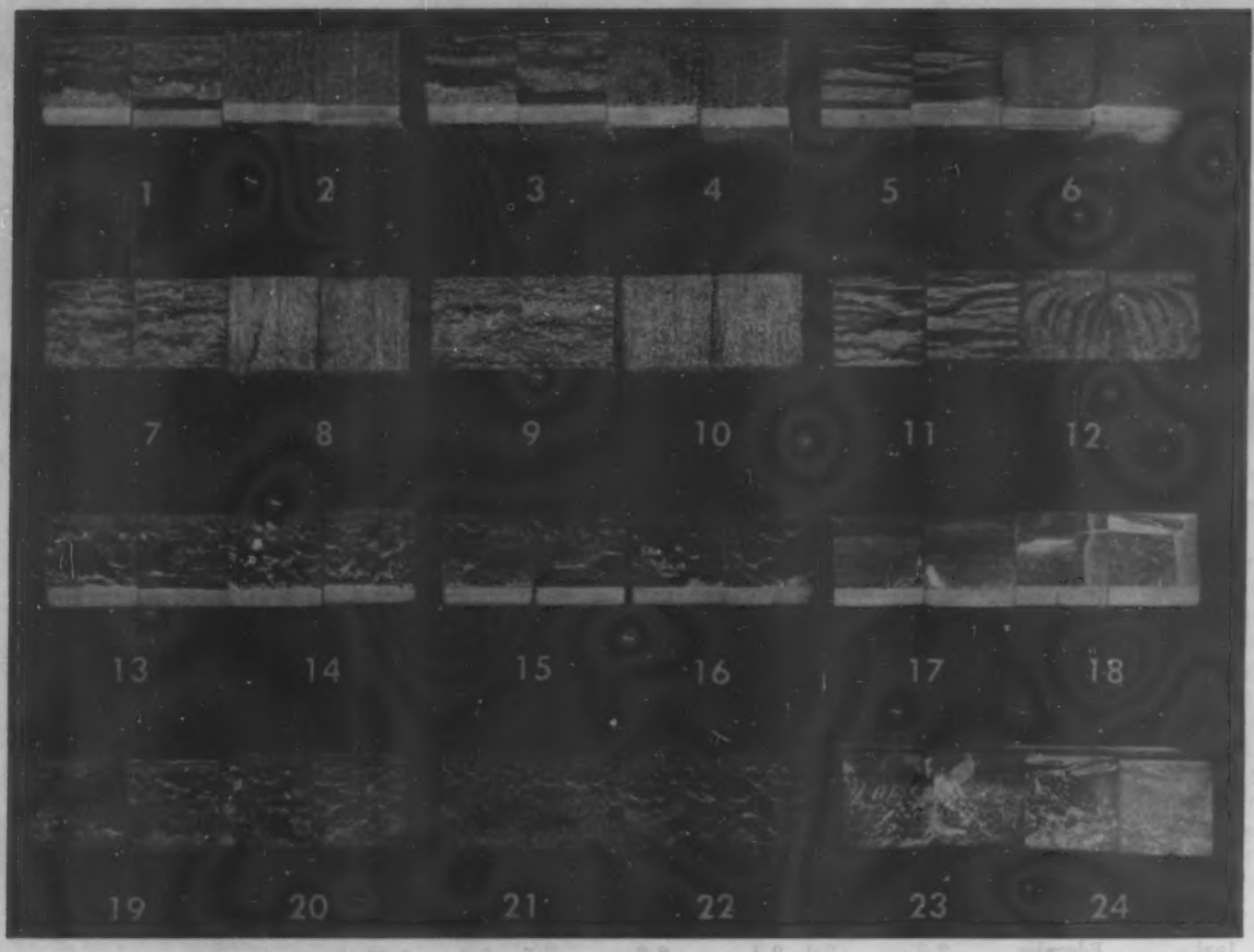


6—*Effect of notch depth on Izod impact test results from molded cord-filled phenolic bars ½ in. square*

TABLE V.—COMPARISON OF NOTCHED AND UNNOTCHED IZOD AND CHARPY IMPACT STRENGTH OF PLASTICS[a]

Type of impact test	Application of test	Notched impact strength: Average ft.-lb./in. of notch	Notched impact strength: Range ft.-lb./in. of notch	Unnotched impact strength: Average ft.-lb./in. of width	Unnotched impact strength: Range ft.-lb./in. of width	Notched / Unnotched	Ratios of average impact strength: Notched tests: Izod	Ratios of average impact strength: Notched tests: Charpy	Ratios of average impact strength: Unnotched tests: Izod	Ratios of average impact strength: Unnotched tests: Charpy
Methyl methacrylate										
Izod	Flatwise	0.45	0.37– 0.50	4.43	4.2 – 4.9	0.10	0.96	0.66		
Charpy	Flatwise	0.47	0.43– 0.50	6.7	6.0 – 7.0	0.07				
Cellulose acetate										
Izod	Flatwise	1.40	1.08– 1.57	21.7	17 –29	0.065	0.82	..		
Charpy	Flatwise	1.70	1.67– 1.73	...	.....	..				
Paper phenolic laminate (XX)										
Izod	Flatwise	2.29	1.85– 2.50	3.94	3.7 – 4.2	0.58	0.54	0.58		
Charpy	Flatwise	4.23	3.17– 4.67	6.80	5.40– 9.33	0.62				
Izod	Edgewise	0.56	0.55– 0.60	6.17	5.17– 7.03	0.091	0.92	0.62		
Charpy	Edgewise	0.61	0.57– 0.67	7.21	7.00– 7.60	0.085				
Fine-fabric phenolic laminate (L)										
Izod	Flatwise	4.38	3.84– 4.85	10.4	10.1 –10.8	0.42	1.04	0.65		
Charpy	Flatwise	4.20	4.17– 4.33	15.9	14.3 –16.7	0.26				
Izod	Edgewise	2.22	2.20– 2.24	9.63	8.33–10.73	0.23	0.92	0.74		
Charpy	Edgewise	2.41	2.25– 2.50	13.0	11.9 –14.3	0.18				
Coarse-fabric phenolic laminate (C)										
Izod	Flatwise	2.70	2.54– 2.84	6.10	5.3 – 7.0	0.44	0.77	0.98		
Charpy	Flatwise	3.50	3.33– 3.66	6.25	6.07– 6.60	0.56				
Izod	Edgewise	1.87	1.77– 1.97	3.47	2.67– 4.17	0.54	1.28	1.09		
Charpy	Edgewise	1.46	1.33– 1.54	3.19	3.43– 4.63	0.46				
Muslin allyl laminate										
Izod	Flatwise	2.2	2.05– 2.4	5.1	3.8 – 6.0	0.43	0.83	0.75		
Charpy	Flatwise	2.61	2.40– 3.10	6.8	4.8 – 7.8	0.38				
Izod	Edgewise	1.5	1.21– 1.79	4.6	3.7 – 5.2	0.33	0.75	0.90		
Charpy	Edgewise	2.0	1.7– 2.2	5.1	4.0 – 6.7	0.39				
Duck allyl laminate										
Izod	Flatwise	4.2	3.8– 4.5	10.9	9.8 –11.5	0.38	0.42	0.69		
Charpy	Flatwise	9.9	7.7–12.8	15.8	14.3 –16.5	0.62				
Izod	Edgewise	2.3	2.1– 2.4	8.2	7.7 – 8.6	0.28	0.72	0.73		
Charpy	Edgewise	3.2	3.1– 3.4	11.2	10.8 –12.0	0.29				
Kraft-paper allyl laminate										
Izod	Flatwise	3.0	2.5 – 3.8	6.7	6.5 – 7.0	0.45	0.41	0.73		
Charpy	Flatwise	7.3	7.0 – 7.8	9.1	8.8 – 9.5	0.80				
Izod	Edgewise	0.79	0.75– 0.83	6.3	6.9 – 6.8	0.12	0.85	0.78		
Charpy	Edgewise	0.93	0.83– 1.02	8.1	7.2 – 8.5	0.11				
Compressed maple, high resin, 6										
Izod	Flatwise	6.00	5.33– 6.33	10.67	6.5 –16.7	0.56	0.70	0.81		
Charpy	Flatwise	8.62	7.67– 9.50	13.1	11.8 –14.3	0.66				
Izod	Edgewise	5.10	4.67– 5.33	9.7	7.8 –12.1	0.59	0.73	1.00		
Charpy	Edgewise	6.93	6.17– 7.83	9.70	8.83–10.6	0.71				
Compressed maple, low resin, 7										
Izod	Flatwise	7.7	6.0 – 8.7	15.4	13.5 –16.7	0.50	0.75	1.14		
Charpy	Flatwise	10.3	8.5 –11.5	13.5	11.8 –15.3	0.76				
Izod	Edgewise	5.9	5.0 – 7.2	10.0	8.5 –11.8	0.59	0.83	0.92		
Charpy	Edgewise	7.1	6.2 – 7.8	10.9	10.1 –11.7	0.65				
Compressed birch, phenolic, 8										
Izod	Flatwise	3.11	2.75– 3.55	7.67	7.3 – 8.0	0.40	0.81	..		
Charpy	Flatwise	3.85	3.00– 4.83	...	.....	..				
Izod	Edgewise	2.79	2.50– 2.98	6.43	5.3 – 7.7	0.43	1.14	..		
Charpy	Edgewise	2.45	2.00– 3.16	...	.....	..				
Compressed birch, phenolic, 10										
Izod	Flatwise	6.4	5.8 – 7.0	13.1	10.0 –16.0	0.49	1.06	1.08		
Charpy	Flatwise	6.0	4.7 – 7.1	12.1	9.7 –16.5	0.49				
Izod	Edgewise	4.5	3.7 – 5.5	14.6	14.1 –16.3	0.31	0.97	1.16		
Charpy	Edgewise	4.7	4.0 – 5.7	12.5	9.8 –15.3	0.37				
Compressed birch, polyvinyl-formal, 13										
Izod	Flatwise	6.3	5.0 – 7.8	12.1	10.0 –14.0	0.52	0.74	1.24		
Charpy	Flatwise	8.5	7.8 – 9.7	9.7	8.7 –10.8	0.87				
Izod	Edgewise	3.6	2.7 – 4.7	11.3	8.0 –15.9	0.32	0.61	1.20		
Charpy	Edgewise	5.9	4.8 – 6.7	9.4	6.7 –10.5	0.63				

[a] Five lengthwise specimens of each material were tested to obtain each average value. In the notched tests the specimens were notched flatwise. All specimens were conditioned for at least 96 hours at 77° F. and 50 percent relative humidity prior to test.

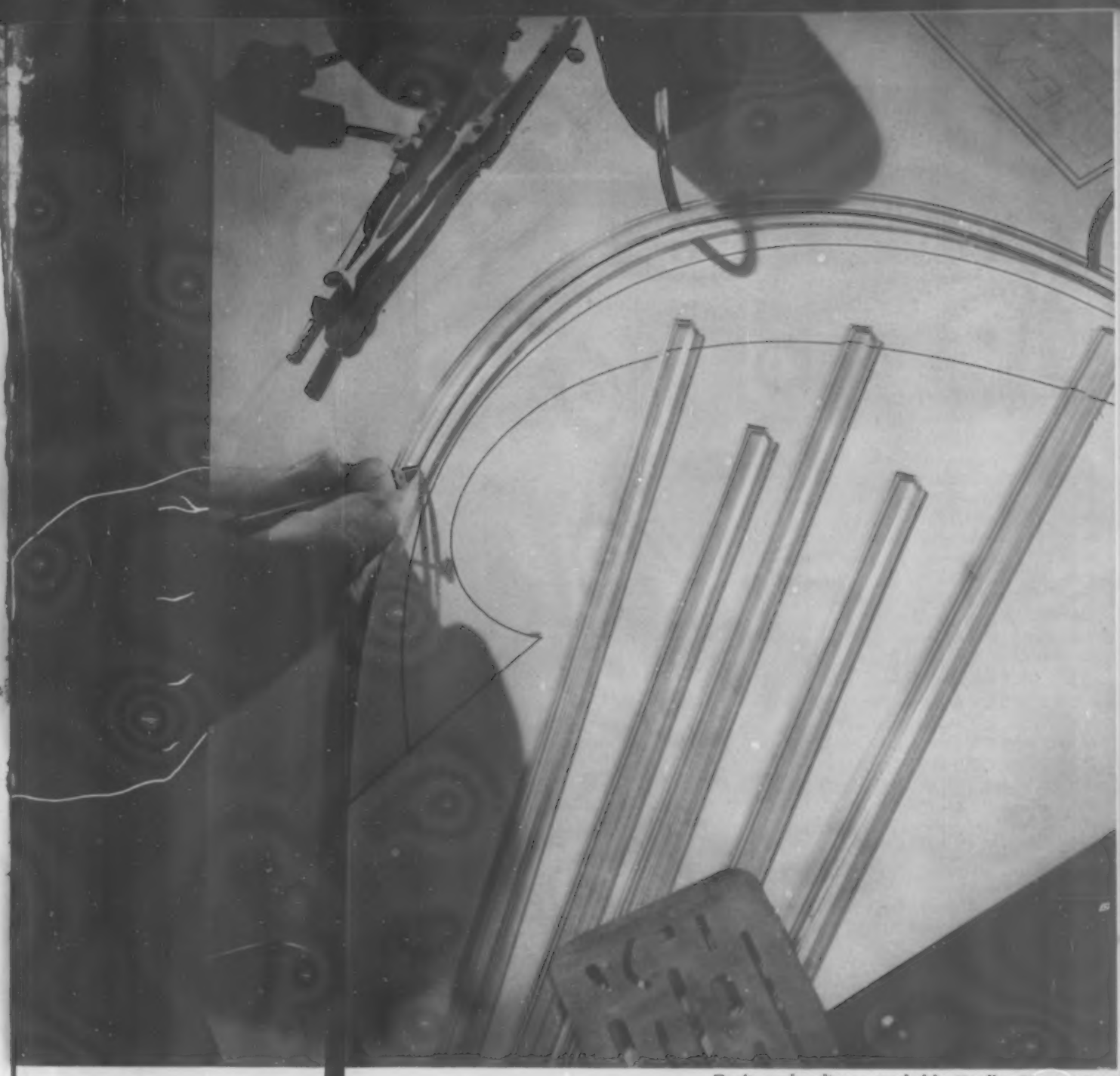


*Figs. 7 and 8**—*Types of fractures of Izod and Charpy impact specimens. All specimens longitudinal*

Specimen No.	*Type of specimen*	*Application of load*	*Material*
1	Notched	Flatwise	Coarse-fabric phenolic laminate (C)
2	Notched	Edgewise	Coarse-fabric phenolic laminate (C)
3	Notched	Flatwise	Fine-fabric phenolic laminate (L)
4	Notched	Edgewise	Fine-fabric phenolic laminate (L)
5	Notched	Flatwise	Paper phenolic laminate (XX)
6	Notched	Edgewise	Paper phenolic laminate (XX)
7	Unnotched	Flatwise	Coarse-fabric phenolic laminate (C)
8	Unnotched	Edgewise	Coarse-fabric phenolic laminate (C)
9	Unnotched	Flatwise	Fine-fabric phenolic laminate (L)
10	Unnotched	Edgewise	Fine-fabric phenolic laminate (L)
11	Unnotched	Flatwise	Paper phenolic laminate (XX)
12	Unnotched	Edgewise	Paper phenolic laminate (XX)
13	Notched	Flatwise	Compressed maple, low resin, 6
14	Notched	Edgewise	Compressed maple, low resin, 6
15	Notched	Flatwise	Compressed maple, high resin, 7
16	Notched	Edgewise	Compressed maple, high resin, 7
17	Notched	Flatwise	Cellulose acetate
18	Notched	Flatwise	Methyl methacrylate
19	Unnotched	Flatwise	Compressed maple, low resin, 6
20	Unnotched	Edgewise	Compressed maple, low resin, 6
21	Unnotched	Flatwise	Compressed maple, high resin, 7
22	Unnotched	Edgewise	Compressed maple, high resin, 7
23	Unnotched	Flatwise	Cellulose acetate
24	Unnotched	Flatwise	Methyl methacrylate

* For Fig. 8, see back of book, page 184.

2.28 and 2.26 ft.-lb. per in. of notch, respectively. Tests were then made on molded cord-filled phenolic material with notch depths ranging from 0.086 to 0.122 inch. These specimens absorbed varying amounts of energy ranging from 5.4 to 8.4 ft.-lb. per in. of notch. In general for the molded material, the specimens having the deepest notch and, therefore, the greatest total specimen volume, absorbed the most energy. These results are plotted in Fig. 6. Considerably more scatter was noted in the results for the cord-filled material, probably because of a variation in the number of cords in different sections of the specimens, but the results obtained for the Grade XX laminate were on the other hand very consistent because of the uniformity of construction of that type material. No definite reason can be assigned (*Please turn to page 184*)



Draftsmen's splines extruded by Yardley Plastics Co.

Tenite for plane curves

Draftsmen's splines continuously extruded of transparent Tenite are used by the Army Air Forces to draw accurate curves. Extruded with an H-shaped profile, they are held in place by "dogs" inserted in the channels. Because of the uniform flexibility and resilience of Tenite, the splines can be made to take any desired curvature.

An exceptionally tough material, Tenite makes durable, virtually unbreakable instruments. Other pieces of drafting equipment molded or extruded of Tenite include architects' and engineers' scales, T-squares, straight edges. Complete information about Tenite may be obtained by writing TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENNESSEE.

AN EASTMAN PLASTIC

H-P-M *All-Hydraulic* PRESSES for Modern Compression Molding

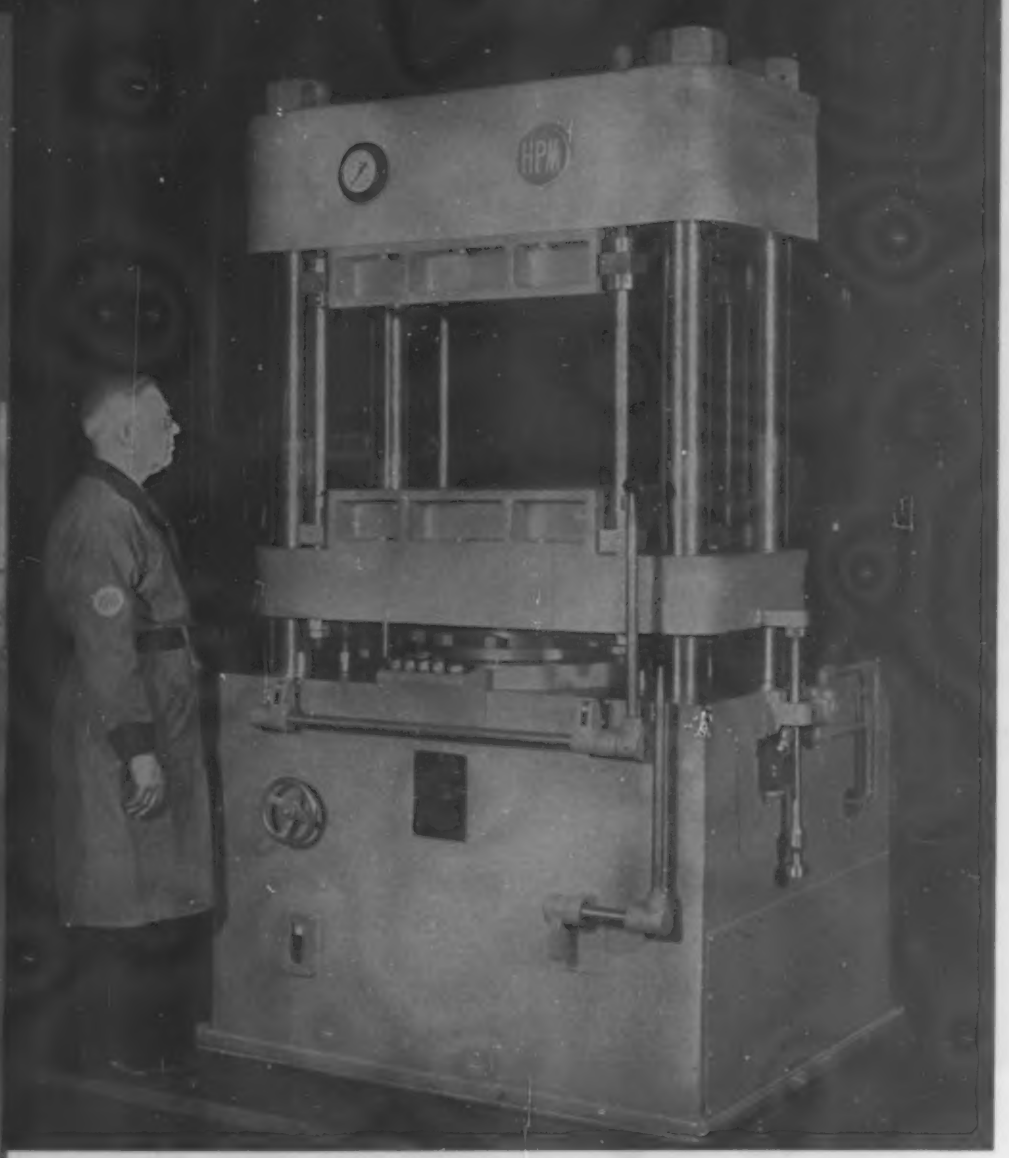
50-Ton, 18" x 18" platens.

100-Ton, 24" x 18" platens.

150-Ton, 24" x 24" platens.

200-Ton, 30" x 24" platens. Larger sizes on special order.

H-P-M compression presses, regardless of size, incorporate the same basic design, and each press employs the same type of hydraulic power unit.



Completely automatic, except for loading and unloading molds. H-P-M compression plastics molding presses are arranged for operation of semi-automatic molds equipped with knockouts. Operating features include—rapid mold closing, automatic slow-down, adjustable slow close, breathing, rapid mold opening and automatic ejection. All press actions are hydraulically operated.

Each press is driven by an H-P-M HYDRO-POWER radial, piston type hydraulic pressure generator with electric motor drive. Only connections required to put press in operation are electric power and cooling water. Oil is used as the hydraulic pressure medium.

H-P-M designs and builds the press and operating system complete, including the hydraulic pump, valves and controls. Write today for bulletin 4403.

HPM

All-Hydraulic PLASTICS MOLDING MACHINES

THE HYDRAULIC PRESS MFG. CO.

Mount Gilead, Ohio, U. S. A.

District Sales Offices: New York, Philadelphia, Cleveland, Detroit and Chicago—Representatives in principal cities

TECHNICAL BRIEFS

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

Chemistry

EFFECT OF CHEMICAL STRUCTURE ON PHYSICAL PROPERTIES OF SYNTHETIC PLASTICS. W. O. Baker. Bell Labs. Record 22, 637-40 (1944). The properties of a plastic are determined by two structural factors, namely, the concentration of attractive centers along the molecular chains and the degree of order of the molecules. The degree of order may be changed by heat-treatment by adding plasticizers or by introducing side groups in the molecule.

COPOLYMERIZATION OF CHLOROSTYRENE WITH STYRENE AND METHYL METHACRYLATE. S. N. Ushakov and P. A. Matuzov. J. Applied Chem. (U. S. S. R.) *17*, 52-9 (1944); Chem. Abstracts *39*, 1321 (Mar. 20, 1945). The copolymerization of chlorostyrene with styrene and methyl methacrylate was studied. All the products are hard, stable, colorless, transparent solids.

CONDENSATION OF FORMALDEHYDE WITH UREA AND MELAMINE. W. Feast. British Plastics *17*, 36-44, 66-73 (Jan. and Feb. 1945). The information available on the mechanism of the condensation of urea and melamine with formaldehyde to form resins, and on the structure of the resins is reviewed. The following conclusions are reached: In its reaction with formaldehyde, urea assumes the asymmetric form of isourea which contains a primary imino and a secondary amino group. The primary monomethylolurea may condense, intramolecularly, to form a cyclic monomer or, intermolecularly, to form a cyclic dimer of methyleneurea. In addition, the methylol may trimerize and, through inter-trimeric condensation, lead to condensates and resins of a cellular pattern composed of triazine nuclei linked by dimethyleneurea bridges and terminated by monomethyleneurea peripheries.

Following primary methylolation, further formaldehyde readily unites a pair of secondary groups by a methylene bridge. The primary methylols may then condense to etheric form and Goldsmith's compound is formed. Trimerization of the primary or secondary methylols also leads to development of complex structures of the same cellular pattern as the primary cellular condensates; but differing therefrom in that the bridges have the structure of Goldsmith's compound, and by the replacement, partly or wholly, of the methyleneurea peripheries with others of a cyclic ether form. Dimethylolurea condenses more slowly than a mixture of urea and formaldehyde, and the secondary bridge may assume forms intermediate of dimethylolurea and Goldsmith's compound. Resinous properties appear when the cellular structures contain 8 nuclei, corresponding to a molecular weight of the order of 2,000.

The structures derived from urea are wholly primary or wholly secondary. The usual urea-formaldehyde resins are of the secondary type with peripheries wholly or mainly of etheric form; some dehydration of bridges may occur, leading to cross-linked layers of cells. Melamine reacts in a manner similar to urea, i.e., through primary and secondary groups, and the products acquire the characteristics of those groups. Since melamine is already in trimeric form, the methylols readily condense. According to the content of primary and secondary groups, the condensates may possess primary or secondary attributes, or both. In the condensates and resins there is a tendency to hydration. Inasmuch as the primary and secondary groups of urea and melamine derive from cyanamide, it is possible that the primary and secondary condensations, discussed above, apply to cyanamide derivatives in general.

THE THERMODYNAMICS OF HIGH-POLYMER SOLUTIONS — I. THE FREE ENERGY OF MIXING OF SOLVENTS AND POLYMERS OF HETEROGENEOUS DISTRIBUTION. R. L. Scott and M. Magat. J. Chem. Phys. *13*, 172-7 (May 1945). The theories of Flory and Huggins for the free energy of mixing of a homogeneous chain polymer of uniform molecular weight with a single uniform solvent have been extended to the case of a polymer mixture of varying chain lengths with a mixture of solvents. By making similar assumptions as those of Huggins, and utilizing familiar statistical mechanical methods, the partial molal free energy of mixing of the solvent is found to be

$$\overline{\Delta F}_0 = RT[\ln \Phi_0 + (1-\Phi_0)\ (1 - 1/\overline{m}_n) + \mu(1-\Phi_0)^2]$$

where Φ_0 is the volume fraction of solvent, $\overline{m}_n$ a simple function of the number average molecular weight, and μ a constant characteristic of the polymer-solvent mixture (consisting largely of a heat term, but also including γ, the coordination number of the rubber segments). By assuming that a mixture of two solvents behaves like a new homogeneous liquid, a method of calculating μ for such mixtures is developed. Applications of these formulas to solubility and fractionation are shown in the subsequent article. II. THE SOLUBILITY AND FRACTIONATION OF A POLYMER OF HETEROGENEOUS DISTRIBUTION. R. L. Scott. Ibid. 178–87. The free energy relations for heterogeneous molecular weight distributions developed in the above article are applied to problems of solubility and fractionation. Critical conditions for solubility are obtained. A rigorous expression for the solubility is derived, although certain approximations are made to facilitate calculation, and to permit extension to polymers which are part "gel." Following the same methods the thermodynamic equilibria involved in fractionation are described by mathematical expressions which permit a comparison of the extraction and precipitation methods.

THE INFLUENCE OF MOLECULAR FLEXIBILITY ON THE INTRINSIC VISCOSITY, SEDIMENTATION AND DIFFUSION OF HIGH POLYMERS. R. Simha. J. Chem. Phys. *13*, 188–95 (May 1945). Expressions for the mean square separation of chain ends and modifications of the formula for an ideal coil are discussed. On the basis of these and of the hydrodynamic theory of intrinsic viscosity, an interpretation of the modified Staudinger rule is offered. It relates the exponent of the molecular weight to a flexibility parameter of the chain in a given solvent, varying between zero and one. By means of the frictional ratio, the sedimentation constant and the diffusion constant, respectively, are connected with the degree of polymerization. The limiting dependence of sedimentation and diffusion rate upon molecular weight for a straight chain and an ideal coil is also found in this manner. A comparison shows satisfactory agreement between values for the degree of polymerization found from intrinsic viscosity and those determined from sedimentation or diffusion rates, for certain cellulose esters and starch derivatives.

SIMULTANEOUS POLYMERIZATION AND DEGRADATION IN POLYMER SYSTEMS: STYRENE IN TOLUENE SOLUTION. R. Mesrobian and A. Tobolsky. J.A.C.S. *67*, 785–7 (May 1945). The existence of simultaneous polymerization and depolymerization of styrene and polystyrene in toluene solutions is shown experimentally.

FREE RADICALS IN POLYMERIZATION PROCESSES. S. Medvedev, O. Koritzkaya, and E. Alexeyeva. Acta

Physicochimica U.S.S.R. *19*, No. 6, 457–82 (1944). It is shown that in the liquid-phase polymerization of β-chlorobutadiene proceeding under the action of benzoyl peroxide or tetraline hydroperoxide, the free radicals may be detected by two methods: 1) evolution of iodine from hydrogen iodide and 2) addition of iodine. The second method renders satisfactory quantitative results. Increase in amount of free radicals in the process of chloroprene polymerization is due 1) to increase in the viscosity of the medium, hindering interaction between radicals (chain termination) and 2) to branching of polymer chains. Branching arises as a result of the activation of double bonds in the growing particle at the expense of the energy liberated in the successive acts of growth. The kinetics of liquid-phase polymerization of chloroprene is determined by the number of radicals found in the system. There exists between the number of radicals and the amount of polymerized chloroprene (in case of benzoyl peroxide) a direct proportionality indicating that the process is a steady state. Too, the kinetic equation derived for the process, occurring in presence of benzoyl peroxide is in fair agreement with the experimental results which are obtained.

Properties

THE EFFECT OF SOLVENT TYPE ON THE VISCOSITY OF VERY DILUTE SOLUTIONS OF LONG-CHAIN POLYMERS. E. M. Frith. Trans. Faraday Soc. *41*, 17-27 (Jan. 1945). A semi-quantitative discussion is given of the viscosity relationships of polymers in various solvents. Quasi-thermodynamic reasoning, based on modern statistical theories, shows how the slope of the ordinary viscosity concentration curve is related to the interaction energy between solvent and polymer, and it is also shown how small differences in interaction energy appreciably alter the slope. These differences are traced back to slight kinking of the long molecular chains in agreement with the qualitative views of Mark. Retention of a solvent effect on specific viscosity at zero concentration is demonstrated but not proved.

A THEORY OF THE CALENDER EFFECT IN RUBBER-LIKE MATERIALS. L. Bilmes. Trans. Faraday Soc. *41*, Part 2, 81-7 (Feb. 1945). The facts relating to the calender effected are briefly stated and illustrated by experimental data obtained with calendered plasticized polyvinyl sheet. The nature of rubber-like deformation is outlined. A theory of the calender effect is proposed in terms of a mechanical model whose relation to molecular structure is indicated. The theory postulates that temperature dependent yield values are associated with the mechanisms of high elastic deformation and plastic flow.

SOLUTION AND SWELLING PHENOMENA IN CELLULOSE ESTERS, II. A. Tager and V. A. Kargin. Acta Physicochim. U. R. S. S. *14*, 713-36 (1941); Chem. Abstracts *39*, 452-3 (Feb. 10, 1945). The heats of solution and swelling of several cellulose derivatives in various solvents were determined. Some representative results are as follows: cellulose nitrate (11.83 percent nitrogen) in acetone 16 to 18 cal./g. for concentrations ranging from 0.2 to 2.1 percent, in methyl alcohol 14.3 cal./g., in ethyl alcohol 9.7 cal./g., in higher alcohols zero; cellulose acetate (0.56 percent acetyl) in acetone 6.9 to 10.6 cal./g. for concentrations ranging from 0.3 to 5.8 percent. Values for methyl-ethyl ketone and methyl-propyl ketone are similar to those for acetone. The polymer molecular components interact more or less independently with a solvent; this phenomenon indicates that the polymer chains are very flexible. The solution reaction involves large changes in entropy which, as a rule, exceed the energy of the interaction.

SOFTENING TEMPERATURE OF POLYMERS. A. P. Aleksandrov and Y. S. Lazurkin. Doklady Akad. Nauk. S. S. S. R. *43*, 396-9 (1944); Chem. Abstracts *39*, 836 (Feb. 20, 1945). The correlation between the softening temperature, molecular weight of the resin and proportion of monomer in 16 polystyrene and 11 polymethyl-methacrylate resin-monomer mixtures was studied. As the proportion of monomer was increased the softening temperature decreased. No correlation between the softening temperature and the molecular weight of the resin was observed. The softening of high polymers is not dependent on the mobility of individual units or parts of the molecules. A small number of cross-links in a polymer has little effect on the softening temperatures. When the number of cross-links approaches the number of links in the chain, the softening temperature is increased.

THE EFFECT OF TEMPERATURE ON THE DENSITY OF POLYTHENE. E. Hunter and W. G. Oakes. Trans. Faraday Soc. *41*, Part 2, 49-56 (Feb. 1945). The densities of polythene specimens between 0 and 170° C. were measured; also the thermal expansion of a specimen between −178 and 30° C. The results are consistent with the theory that the long molecules of the solid are partly in a crystalline and partly in an amorphous condition in proportions dependent on temperature. Rough values of the crystalline fraction at different temperatures were calculated. They show an amount of crystalline material (55 percent at room temperature) which is unchanged up to about 70° C., but thereafter falls more and more rapidly until the substance becomes wholly amorphous at a temperature (in the range 100 to 120°) dependent on the nature of the specimen. The method of calculation is likely to give low values for the proportion of crystalline material since it is improbable that the density in the amorphous regions of the solid is as high as that of the true liquid. Densities of molten polythene show little dependence on average molecular weight, but the temperature at which crystalline material first appears on cooling is raised by increase in molecular weight. Specimens of different composition differ markedly in density at 100° C., and consequently in their proportions of crystalline material at this temperature. The specimen examined at sub-normal temperatures showed signs of a minor transition at −45° C. In the liquid, the density rapidly becomes constant after change of temperature; between 120 and 60° C. at least a day is needed. Below 60° C. constancy is reached after a few hours. By shock cooling of the liquid rather than slow cooling, a solid of slightly lower density is obtained which partially reverts to the density of the slowly cooled form on annealing at 100° C. There is no large difference between the fractions of crystalline material in the two forms at normal temperatures. It is concluded that above 60° C. there is no severe hindrance either to the setting up of an equilibrium between crystalline and amorphous matter, or to the shift of equilibrium with temperature, or to change in density of the amorphous regions with temperature by segmental movement. Below 60° C. the ratio of crystalline to amorphous material appears to be frozen, although segmental adjustment with temperature changes continues in the amorphous regions. There are signs that this ceases at a sub-normal temperature.

Testing

PRECISE METHOD FOR ISOLATION OF HIGH POLYMERS. F. M. Lewis and F. R. Mayo. Ind. Eng. Chem. Anal. Ed. *17*, 134-6 (Mar. 1945). A new procedure is described by which solvents and monomers may be separated from polymers and the latter may be brought to constant weight in a form convenient for handling and analysis. The polymer is dissolved in solvent, the solution frozen and the solvent sublimed from the mass. Benzene is used to purify polystyrene by this procedure; the purified product is left as a soft, fluffy, porous solid from which traces of volatile impurities are removed.

ANALYTICAL ASPECTS OF PLASTICS. H. Barron. British Plastics *16*, 339-48, 460-4 (Aug. and Oct. 1944) and 56-62 (Feb. 1945). The various procedures used for separating and identifying plastics and plasticizers and for determining certain components of plastics are described. The topics considered include decomposition by heat; fluorescence in ultraviolet light; specific gravity; dry distillation; saponification number; elemental analysis; separation in selected solvents; analysis of phenolic resins; acetone ex-

tract; determination of phenol, resol, formaldehyde, aniline, furfural, urea and thiourea, amino resins, cellulose plastics, polystyrene, acrylic resins, polyvinyl chloride; plasticizers determination of dibutyl phthalate and tricresyl phosphate; lubricants; and analysis of calcium stearate and white lead.

OXYGEN PENETRATION. M. Kleiber and F. R. Smith. Modern Packaging *18*, 117-18, 140 (Jan. 1945). A method for determining the gas transmission rate of the finished package is described. Packages made by different manufacturers from identical materials may vary.

NEW MACHINES FOR CREEP AND CREEP-RUPTURE TESTS. M. J. Manjoine. Trans. A. S. M. E. *67*, 111-16 (Feb. 1945). Two new creep-rupture machines are described. One, a lever-arm creep machine, combines the compactness of a multiple unit with the flexibility of an individual one. Each of the 8 specimens on the machine is equipped with an extensometer which gives a direct reading of the extension on a counter. A continuous record of the elongation of all the specimens is made by photographing these counters periodically. Two types of extensometers are used; one which gives readings in hundred-thousandths of an inch for measuring small strains up to 2 percent, and a second which records in ten-thousandths of an inch for strains up to rupture. The other machine is a radically different type of creep-rupture machine which loads the specimen through a stiff spring and records a continuous creep-to-rupture curve without the use of an extensometer on the specimen. Occupying a space of only 15 x 15 inches, this machine has a capacity of 10 tons. It can also be used for making short-time tensile tests, constant-strain-rate tests and relaxation tests.

MOLECULAR THEORY OF THE SCATTERING OF LIGHT IN FLUIDS. B. H. Zimm. J. Chem. Phys. *13*, 141–5 (Apr. 1945). A molecular theory of the scattering of light by fluids of isotropic molecules is developed, utilizing recent advances in the statistical mechanics of condensed phases. The results are shown to be the same in first approximation as those of the continuous theory based on fluctuations originally proposed by Smoluchowski and Einstein. Higher approximations of the molecular theory are especially applicable to the study of critical opalescence and fluids which consist of very large molecules.

AN INVESTIGATION OF THE DETERMINATION OF MOLECULAR WEIGHTS OF HIGH POLYMERS BY LIGHT SCATTERING. P. M. Doty, B. H. Zimm and H. Mark. J. Phys. Chem. *13*, 159–66 (May 1945). The determination of the molecular weights of large molecules by measuring the turbidity of the solution and the change in index of refraction with concentration is discussed. The apparatus, its calibration and the technique used are treated together with a comparison between molecular weights measured by this method and other methods. There is also a presentation of the effect of polymolecularity.

Synthetic rubber

SOME RELATIONS BETWEEN STRESS, STRAIN AND TEMPERATURE IN PURE-GUM VULCANIZATE OF GR-S SYNTHETIC RUBBER. F. L. Roth and L. A. Wood. J. Applied Phys. *15*, 749-57 (Nov. 1944). Stress-temperature relations at constant elongation and at constant length were studied in a pure-gum vulcanizate of GR-S. This information is useful for calculations involved in the theory of elastic behavior, and furnishes practical data regarding tensile properties at different temperatures. The compounding recipe was: 100 parts by weight of GR-S, 2 parts of sulfur, 1 part of zinc oxide, and 0.5 part of zinc dibutyl dithiocarbamate. The specimens were first held at constant length and constant temperature for a period of ½ to 2 hr., after which time the effects of relaxation of stress during the observation of stress-temperature relations were negligible. The value of the stress after relaxation at each elongation was used to plot a stress-strain curve. The stress-temperature relations observed for temperatures below the relaxation temperature were linear and reproducible on successive runs of increasing and decreasing temperature. When the temperature was raised above the relaxation temperature, straight lines were not obtained, since further relaxation occurred at the higher temperatures. The intercepts at 0° K. for the lines obtained below the temperature of relaxation are useful in evaluating the internal energy changes. The intercepts of the lines representing the experiments at constant elongation were found to be negative. The absolute values were of the order of 10 percent of the stress after relaxation for the lowest elongations, and increased to almost 30 percent at the highest elongation.

RETRACTION AND STRESS PROPAGATION IN NATURAL AND SYNTHETIC GUM AND TREAD STOCKS. R. A. Mrowca, S. L. Dart and E. Guth. J. Applied Phys. *16*, 8-19 (Jan. 1945). The retraction after extension of natural and synthetic rubbers was studied 1) by means of a stylus which was fastened to the specimen and which marked a revolving drum, and 2) strobolux photography.

SYNTHETIC RUBBER DEVELOPMENT. E. R. Gilliland. Chem. Eng. News *23*, 129-31 (Jan. 25, 1945). The developments of the synthetic rubber industry during 1944 are reviewed. With completion of a $750,000,000 construction program during 1944, synthetic rubber in the next few years is expected to compete with natural rubber in a free market. Availability of synthetics will prevent repetition of past rubber price fluctuation, while competition will result in intense research, testing and improvement

RISE OF TEMPERATURE ON FAST STRETCHING OF BUTYL RUBBER. S. L. Dart and E. Guth. J. Chem. Phys. *13*, 28-36 (Jan. 1945). The rise of temperature on fast stretching of natural and synthetic rubber stocks was investigated by Dart, Anthony and Guth. Since then the experimental technique has been improved and the taking of data greatly simplified. Temperature rises of up to 15° C. for extensions up to 700 percent are recorded by a fast galvanometer of moderate sensitivity. A less fast but more sensitive galvanometer is employed to record changes of temperature as small as 0.001° C. for 0 to 80 percent extension. In accordance with early work (1859) by Joule on natural gum it was found that Butyl gum stocks also show an initial cooling effect. This passes at a thermoelastic inversion point into a heating effect. In agreement with the recent theory by James and Guth, the thermoelastic inversion point was found to depend solely upon the thermal expansion coefficient of the unstretched stock. The coefficient of thermal expansion was measured for Butyl stocks. Butyl tread stocks also show the thermoelastic inversion point. The rise in temperature on extension is a slowly rising function of the extension with a steep upward turn and almost linear continuation after the onset of crystallization. The samples were kept extended for a minute and then the cooling arising on retraction was also measured. The negative of the cooling on retraction plotted against extension falls, as it should, under the extension curve, but crosses it at the onset of crystallization. For Butyl gum stocks this crossing takes place at rather high (600 percent or more) extensions in agreement with x-ray work. More similarity was found between Butyl and Hevea tread stocks than between the corresponding gum stocks. Loading shifts the onset of crystallization to a range of smaller extensions. The residual rise in temperature after an extension and immediate fast cycle retraction was also observed. This quantity is a measure of internal friction in Butyl rubber and is closely connected with rebound and free vibration tests. The method described has a twofold application for development work: 1) Changes of the temperature on extension and delayed retraction indicate in a simple manner the onset and progress of crystallization. 2) Changes of the temperature in a fast cycle give an estimate for internal friction.

SYNTHETIC RUBBER PROCESSING. GR-S. R. J. Tudor. India-Rubber J. *107*, 571-4, 601-2, 604-5, 665, 667-8, 693, 695-6, 723-6 (1944). The literature on the processing of butadiene-styrene rubber up to June 1943 is reviewed.

PLASTICS DIGEST

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals directly to publishers.

General

POLYMOLECULARITY AND MECHANICAL PROPERTIES OF CELLULOSE ACETATE. A. M. Sookne and M. Harris. Ind. Eng. Chem. *37*, 478–82 (May 1945). The tensile strength, ultimate elongation and folding endurance of films prepared from a series of cellulose acetate fractions and blends were studied. When the mechanical properties are plotted against the intrinsic viscosities (or relative weight-average degrees of polymerization), the results for the fractions and different blends fall on separate curves. In contrast, when the mechanical properties are plotted against the number-average degrees of polymerization, the results for the fractions and all of the blends fall approximately on a single curve for each property. The results are qualitatively consistent with the hypothesis that the mechanical properties of blends are the weight averages of the properties of their components. The results emphasize the importance of the determinations of the number-average degree of polymerization in studying commercial polymolecular materials.

SOME RECENT DEVELOPMENTS IN ENGINEERING MATERIALS. A. Black. Mechanical Eng. *67*. [Ferrous metals, 101-8 (Feb. 1945); Nonferrous metals, 190–8 (Mar. 1945); Synthetics, fuels, and lubricants, 267–74 (Apr. 1945). Glasses, woods, and glues, miscellaneous materials, and processes, 334–43 (May 1945.)] The topics of interest to the plastics industry are glass fiber, glues for wood and plywood, glues for metals, chemical treatment of wood, wood and paper impregnation, and impregnated-wood bearings. There are 485 references in the entire series of articles.

Materials

THE DEVELOPMENT OF POLYTHENE AS A HIGH-FREQUENCY DIELECTRIC. W. Jackson and J. S. A. Forsyth. J. Inst. Elec. Eng. *92*, Part III, 23–37 (Mar. 1945). Since polythene, the high polymer of ethylene, has a power factor of the order of 0.00015 to 0.0003, it is very satisfactory as a high frequency dielectric. However, oxidation may occur during the processing of the material in the manufacture of cables and moldings, and this increases the power factor and may also lead to difficulties in extrusion. These effects may be virtually eliminated by the use of small amounts of antioxidants. The measurable, although low, power factor of pure polythene is hardly concordant with the supposedly nonpolar nature of the substance, and a number of possible explanations of the small basic power factor were investigated. Measurements of power factor over wide frequency and temperature ranges show that its variation for pure polythene is extremely sluggish, but that oxidation causes the appearance of marked peaks; these observations are examined in the light of present theories of dipole loss. A brief account is given of the structure of polythene and of its main properties.

RESINOUS PLASTICIZERS FROM SEBACIC ACID. K. K. Fligor and J. K. Sumner. Ind. Eng. Chem. *37*, 504–8 (May 1945). A sebacic acid polyester plasticizer was developed which shows good compatibility with polyvinyl chloride, vinyl chloride-acetate copolymer, buna-N (oil-resistant type), GR-S, GR-M and cellulose nitrate. When compounded in typical formulations, this plasticizer exhibits outstanding qualities of permanence, heat stability, oil and gasoline resistance, nonflammability, water resistance and nonmigration to adjacent plastics, combined with plasticizing efficiency and low temperature properties equal in some cases to those of the monomeric-type plasticizers. Since the polyester chosen for this work is only representative of a large class of materials, proper choice and suitable combination of raw materials, molecular weight and polymer modification should yield other polymers which may have other desirable properties.

Molding and fabricating

AUTOMATIC DRAWING OF TRANSPARENT CONTAINERS. Modern Packaging *18*, 92–6, 176 (Apr. 1945). The drawing of transparent containers from any thermoplastic sheet material is done by fully automatic machines. It is possible to make up to 90 pieces per minute with one machine. One operator can supervise four to six machines.

NEW HEAT SEALER. Modern Packaging *18*, 121–2 (Mar. 1945). A heat-sealing machine for use with thermoplastic films is described. Originally developed to seal films of vinylidene chloride plastic, it is also suitable for sealing films of polyvinyl chloride and polyethylene as well as rubber derivatives.

Applications

ALL-LAMINATE CONSTRUCTION BIDS FOR AIRCRAFT USES. L. S. Meyer and J. C. Case. Aviation *44*, 141–4 (May 1945). A type of glass fabric-plastic laminate consisting of honeycomb-type core and solid board faces is described. Layers of corrugated glass fabric-plastic laminate are bonded together so that a honeycomb structure is obtained. Thin layers are then cut off crosswise to the grain of the honeycomb to obtain the core sections. The fabrication of a fuselage section of a BT-15 basic trainer is clearly outlined.

RESIN-TREATED PLASTER OF PARIS. H. C. Bryson. Plastics (London) *9*, 181–2 (Apr. 1945). Plaster of Paris objects are impregnated with a solution of a phenolic resin and the resin cured by baking in an oven. The cure must be done slowly to avoid bubbling. The resistance to water and the strength were increased by this method.

FRANGIBLE PLASTIC BULLETS REVOLUTIONIZE AERIAL FLEXIBLE GUNNERY TRAINING. MODERN PLASTICS *22*, 131–138, 198,120 (May 1945). Pacific Plastics *3*, 18–19 (May 1945). Frangible plastic bullets for gunnery training are transfer-molded of a phenolic plastic containing a high proportion of lead. The material has a high thermal conductivity because of the high lead content present.

Coatings

THE PAINTING OF ALUMINUM AND ITS ALLOYS. A. Behr. Paint Manuf. *14*, 301-303 (1944). The preparation of the surface, priming and finishing of aluminum and its alloys are discussed.

POLYMERIZATION OF ISOPRENE BY BLEACHING EARTHS. T. Wagner-Jauregg and T. Lennartz. Berg *76B*, 1161-5 (1943); Chem. Abstracts *39*, 272-3 (Jan. 20, 1945). The preparation of resins from isoprene is described. These products are suggested for use in the formulation of protective coatings.

EVALUATING INSULATING VARNISHES. K. N. Mathes. General Elec. Rev. *48*, 20–9 (May 1945). Discussion of a newly developed method for evaluation of insulating varnishes utilizing a simple cabled-wire test sample. The new method permits the evaluation of properties which have been difficult to appraise in a significant fashion. The method has been used successfully to evaluate penetration, insulation resistance, curing time, dielectric strength, moisture resistance, resistance to heat aging, plastic deformability and flammability.

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each.

POLYVINYL CHLORIDE. H. Berg and M. Doriat (to Alien Property Custodian). U.S. 2,371,868, March 20. Porous articles of polyvinyl chloride are prepared by mixing polyvinyl chloride with a plasticizer which is a solvent for the resin at high temperatures, pulverizing the mixture, and finally heating until the particles are sintered into a porous mass.

POLYMERS. H. Bergk (to Alien Property Custodian). U.S. 2,371,869, March 20. A polymer is prepared by a process of heating an adipic acid diamide with an alkyl halide.

ADHESIVES. C. F. Brown and G. E. Hulse (to United States Rubber Co.). U.S. 2,371,870, March 20. An adhesive comprising cashew-nut shell oil, a phenol, solubilized depolymerized vulcanized rubber and a hardening agent.

FINISH. J. M. Hool (to American Cyanamid Co.). U.S. 2,371,892, March 20. A composition for finishing textiles, comprising a mixture of an alcohol-reacted melamine-aldehyde condensate and a salt of an alkoxypropylamine.

CHLORINATED RUBBER. J. G. Little (to Hercules Powder Co.). U.S. 2,371,899, March 20. An aqueous emulsion comprising a solution of chlorinated rubber and a glycol ester of a rosin ester in a water-immiscible solvent which has been emulsified in water.

PHENOL-ALDEHYDE RESINS. C. Rector and C. F. Schrimpe (to Bakelite Corp.). U.S. 2,371,915, March 20. A resinous composition comprising phenol-aldehyde resin to which has been added a precipitated gelatinous hydrous metal oxide followed by dehydration.

RESIN. P. R. Austin (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,371,943, March 20. A resin comprising a polyvinyl acetal and a secondary diarylamine.

RESIN. E. R. Derby (to Monsanto Chemical Co.). U.S. 2,371,957, March 20. A composition of polyvinyl acetal resin modified with ethyl laurate.

RESIN. W. E. Hanford (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,371,990, March 20. A polyester which on hydrolysis yields a saturated aliphatic monoaldehyde and a dicarboxylic acid.

RESIN. F. W. Hoover and G. T. Vaala (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,371,997, March 20. A resin prepared by reacting urea, an aldehyde, and the salt obtained from a diamine and a dibasic carboxylic acid.

PHENOLIC RESIN. R. W. Auxier (to Westinghouse Electric and Manufacturing Co.). U.S. 2,372,048, March 20. A molded laminated structure comprising a number of layers of a glass fabric coated with an amylaceous material and a coating of an oil-modified phenolic resin with a body of thermoset phenolic resin bonding it.

MAGNET. J. G. Ford (to Westinghouse Electric and Manufacturing Co.). U.S. 2,372,074, March 20. A bonded core comprising laminations of magnetic material bonded by a heat-treated insulating composition of polyvinyl acetal, polyvinyl acetate and a phenol-aldehyde resin binder.

EMULSIONS. H. T. Neher and W. R. Conn (to Rohm and Haas Co.). U.S. 2,372,108, March 20. Thixotropic dispersions of acrylic polymers are prepared by emulsifying the monomer with a cation-active emulsifying agent in water, preparing an aqueous solution of emulsifying agent, heating the solution so as to polymerize the ester, and adding the emulsion to the solution in presence of a catalyst.

ROPE. R. F. Warren, Jr. U.S. 2,372,142, March 20. A rope comprising a plastic material and particles of a lubricant.

PLASTIC. O. H. Yoxsimer (to Westinghouse Electric and Manufacturing Co.). U.S. 2,372,153, March 20. A molded composition comprising cellulose acetobutyrate plasticized with vanillin or coumarin.

MOLDED ARTICLE. B. F. Conner (to Colt's Patent Fire Arms Manufacturing Co.). U.S. 2,372,177, March 27. A method for preparing a molded integral cup-shaped article having two opposed surfaces from a plasticizable resinous material having grain characteristics.

RESIN GLUE. J. F. Corwin and W. R. Moffitt (to Borden Co.). U.S. 2,372,178, March 27. A water soluble urea-formaldehyde resin containing a minor portion of a water-insoluble hydroxystearic acid metallic soap.

COATING. D. Murphy (to Chadeloid Chemical Co.). U.S. 2,372,334, March 27. An opalescent lacquer comprising a cellulose ester, aluminum bronze and a non-metallic pigment.

PLASTIC. A. W. Koon (to Columbian Rope Co.). U.S. 2,372,433, March 27. A moldable composition comprising a web-like body of vegetable fibers impregnated with a dry-heat hardenable resin.

PLASTIC. F. A. Strauss (to Wecoline Products, Inc.). U.S. 2,372,522, March 27. A plastic composition, designed as an interlayer for safety-glass, comprising a vinyl acetal resin plasticized with a fully esterified polyalkylene glycol with a mixture of caprylic and capric acids.

CELLULOSE ESTER. R. E. Fothergill (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,372,565, March 27. Cellulose propionate is prepared by reacting cellulose with propionic acid for four hours and reacting the product with propionic anhydride in the presence of propionic acid and sulfuric acid.

POLYAMIDE. A. F. Smith (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,372,630, March 27. A shaped article is prepared from a high-molecular-weight, synthetic linear polyamide by molding, solidifying by cooling, heating under anhydrous conditions to a temperature above 120° C. but below the melting point until the hardness and stiffness are increased.

POLYMER. G. Allen (to Petrolite Corp., Ltd.). U.S. 2,372,641, Apr. 3. A resinous composition comprising a polycarboxylic-acid-reacted sub-rubbery polymeric polyhydric alcohol ester which is sulfur-converted.

COATING. E. G. Almy (to Atlas Powder Co.). U.S. 2,372,643, Apr. 3. A clear lacquer for coating metals, comprising a film-forming base and an alkyl monoester of malic acid.

WELDING TORCH. W. M. Phillips, Jr. (to Udylite Corp.). U.S. 2,372,737, Apr. 3. A torch for welding thermoplastic material comprising essentially a blast of heated air, a guide and also a smoothing mechanism.

LAMINATING METHOD. R. A. Powell (to Timm Aircraft Corp.). U.S. 2,372,738, Apr. 3. A method for laminating materials consisting of applying to the surfaces a mixture of a heat-hardening

glue and a cold-setting glue, allowing the latter to set under pressure, machining, and finally heating to cure completely the heat-hardening glue.

DECORATIVE PLASTIC. J. C. Boyd. U.S. 2,372,761, Apr. 3. Surface effects are produced on plastic surfaces of one color by annexing thereto an upper or second translucent piece of another color, heat treating so as to cause the upper piece to lose part of its translucency and attain a color in contrast with the untreated portion.

CONDENSATES. E. Segessemann and W. L. Abramowitz (to National Oil Products Co.). U.S. 2,372,797, Apr. 3. Castor oil is reacted with a non-hydroxy fatty acid at 150 to 260° C. and the resulting product is reacted with an aliphatic polyamine at 150 to 260° C.

INJECTION MOLDING. C. Jobst. U.S. 2,372,833, Apr. 3. An injection molding machine for molding plastics.

POLYMER. T. L. Gresham (to B. F. Goodrich Co.). U.S. 2,372,947, Apr. 3. A composition comprising a polymer of vinyl chloride and the ester of an acid of diphenyl ketone.

CELLULOSE DERIVATIVE. F. E. Piech (to Hercules Powder Co.). U.S. 2,372,980, Apr. 3. A plastic composition comprising a cellulose mixed ester and a plasticizer such as *p*-tertiary butyl phenoxy ethanol, *p*-tertiary amyl phenoxy ethanol or else a *p*-tertiary butyl phenoxy ethyl acetate.

COATING. A. B. Richards, J. A. Mickey and J. T. O'Reilly (to Ford Motor Co.). U.S. 2,372,982, Apr. 3. Plastic sheets are temporarily protected by spraying them with an aqueous solution of polyvinyl alcohol having a low surface tension which can be peeled off when protection is no longer required.

SPINNING BUCKET. H. M. Richardson (to General Electric Co.). U.S. 2,372,983, Apr. 3. A spinning bucket consisting of glass-organic fiber cloth impregnated with acid-resistant resinous binder.

POLYMERS. J. C. Cowan and W. C. Ault (to U.S. Department of Agriculture). U.S. 2,373,015, Apr. 3. High polymers are produced by vulcanizing dihydric alcohol polyesters of polymeric acids derived from unsaturated acids.

LIGHT POLARIZER. E. H. Land (to Polaroid Corp.). U.S. 2,373,035, Apr. 3. Predetermined areas of a sheet of transparent plastic material are converted to dichroic light-polarizing areas to form a predetermined image.

RESIN. S. H. Silberkraus (to Monsanto Chemical Co.). U.S. 2,373,058, Apr. 3. A phenol-aldehyde resin is prepared by adding the aldehyde to preheated phenol and refluxing.

RESIN. R. M. Thomas and W. J. Sparks (to Standard Oil Development Co.). U.S. 2,373,067, Apr. 3. A resin prepared by interpolymerizing dimethallyl ether and a vinyl ester.

TREATMENT OF PLASTIC. W. O. Baker (to Bell Telephone Laboratories, Inc.). U.S. 2,373,093, Apr. 10. A solid thermoplastic polymer containing stored stresses is treated to improve cracking resistance by exposing it to a gas at a temperature above its transition point and cooling slowly.

HARMONICA. F. H. Magnus. U.S. 2,373,129, Apr. 10. A plastic reed plate for a harmonica.

POLYMER. R. W. Maxwell (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,373,135, Apr. 10. The condensation product of a highly polymeric hydroxylated polymer and a substituted monocyclic urea.

MOLDING. C. V. Smith (to Univis Lens Co.). U.S. 2,373,201, Apr. 10. An automatic press system for molding disks of resinous material.

VARNISH BASE. W. A. Waldie (to New Wrinkle, Inc.). U.S. 2,373,212, Apr. 10. A wrinkle varnish base is prepared by reacting a rosin modified alkyd resin with an unblown drying oil and blowing the resultant material with air at a temperature of 375 to 400° F.

FILM TREATMENT. H. L. Young (to B. F. Goodrich Co.). U.S. 2,373,215, Apr. 10. An apparatus for treating a film of thermoplastic material.

COATING. W. S. Traylor (to Hercules Powder Co.). U.S. 2,373,278, Apr. 10. A textile fabric is coated without impregnation by a molten mass of ethyl cellulose, a plasticizer and a wax.

PHOTOGRAPHIC STRUCTURE. R. F. Brown (to Defender Photo Supply Co., Inc.). U.S. 2,373,289, Apr. 10. A photographic structure comprising a supporting layer, an emulsion layer and a clear, transparent, waterproof protecting layer of a glycerol phthalate resin.

VINYL POLYMERS. F. K. Schoenfeld (to B. F. Goodrich Co.). U.S. 2,373,347, Apr. 10. A vinyl chloride polymer is agitated in an aqueous suspension of a plasticizer until the plasticizer is absorbed.

PRINTING PLATES. W. C. Toland and E. Bassist (to William Craig Toland). U.S. 2,373,357, Apr. 10. The method of preparing planographic printing plates is improved by applying to the base element a water receptive water insoluble coating of polyvinyl alcohol.

UREA-FORMALDEHYDE RESIN. H. A. Walter (to Libbey-Owens-Ford Glass Co.). U.S. 2,373,362, Apr. 10. A thermosetting composition comprising a urea-formaldehyde resin and cinnamhydroxamic acid, which is used as a latent curing catalyst.

INSULATING MATERIAL. E. G. King (to Armstrong Cork Co.). U.S. 2,373,401, Apr. 10. An insulating material consisting of the set foamed mixture of mineral wool, a water insoluble protein and a water soluble urea- or phenol-aldehyde resin.

ADHESIVE. S. P. Lovell and F. H. Russell (to Beckwith Manufacturing Co.). U.S. 2,373,404, Apr. 10. An adhesive for shoes comprising ethyl cellulose, dewaxed gum dammar, toluene and acetone.

TERPENE POLYMERS. A. L. Rummelsberg (to Hercules Powder Co.). U.S. 2,373,419, Apr. 10. An acyclic terpene having three double bonds per molecule is polymerized by contacting with a metal halide catalyst at −35 to 200° C.

CASTING TECHNIQUE. D. H. Beaton (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,373,446, Apr. 10. Bubble-free solid bodies of acrylic or methacrylic acid esters are prepared by mixing carbon dioxide gas with a syrup comprising a solution of the polymer in the monomer.

SHEET MATERIAL. B. M. Marks (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,373,488, Apr. 10. A syrup adapted for forming cast sheets between two glass plates comprising methyl methacrylate and methacrylic acid as a polymerization catalyst.

RESINS. M. C. Agens (to General Electric Co.). U.S. 2,373,527, Apr. 10. A resin comprising a polymerizable, decarboxylated, partially esterified alpha-unsaturated polycarboxylic acid obtained by heat-reacting the acid with the alcohol in the presence of a cyclic amine capable of decarboxylating the partial esters of such an acid.

ION EXCHANGE RESINS. G. F. D'Alelio (to General Electric Co.). U.S. 2,373,547-8-9, Apr. 10. Cation exchange resins comprising infusible masses consisting of the reaction products of a phenol, an aldehyde, and an aliphatic amino carboxylic acid, or nitrourea or mono substituted nitrourea.

OLEFIN POLYMERS. W. E. Hanford (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,373,561, Apr. 10. The solid resinous reaction product of formaldehyde with a monoolefin in the presence of a peroxide catalyst.

BOOKS AND BOOKLETS

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent post-paid at the publishers' advertised prices.

Plastics in Practice

by John Sasso and Michael A. Brown, Jr.

Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 17, N. Y., 1945

Price, $4.00 **185 pages**

The authors have succeeded in preparing a book on plastics which has a completely new and refreshing approach. Instead of approaching the subject from the standpoint of the various materials and various processes available for molding and forming those materials, they have rather used case histories of successful applications as their premise.

An introduction giving a brief description of most plastics materials, methods of molding and forming, as well as comparative properties and part designing hints, and a very complete cross index helps to round out the usefulness of the book.

It gives the information needed by non-experts and aids such readers in educating themselves in this new field. F.B.S.

National Fire Codes, Vol. I—Flammable Liquids, Gases, Chemicals and Explosives

Compiled by Robert S. Moulton

National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass., 1945

Price $3.00 **591 pages**

The hazard of fire from flammable materials is an ever present menace to industry. In wartime this difficulty has been increased by the necessary influx of untrained workers to chemical plants. It is well, therefore, that employers whose work comes within this category become familiar with the national fire codes.

Volume I in its present edition incorporates the N. F. P. A. standards pertaining to flammable liquids, gases, chemicals and explosives and related reference material not yet in official form.

The Chemical Process Industries

by R. Norris Shreve

Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C., 1945

Price $7.50, Trade Edition **957 pages**

Reflecting present-day teaching trends in chemical engineering, this book follows modern factory practice in breaking down the actual industrial procedures into unit operations and unit processes.

The development of simple fundamental principles for the benefit of students is followed by the detailed treatment of a number of applications of special interest to chemical engineers. Topics covered in the latter manner include thermodynamic properties of fluids, expansion and compression of gases, fluid flow, heat transfer, refrigeration, chemical reaction equilibrium, distillation equilibria and distillation processes.

A wealth of flow sheets and the integration of chemical processes and unit physical operations, as well as the most recent advances in the field, are presented in this treatise which serves as text or reference.

Polymer Bulletin

Published bimonthly by Interscience Publishers, Inc., 215 Fourth Ave., New York 13, N. Y., with the cooperation of the Bureau of High Polymer Research, Polytechnic Institute of Brooklyn

Subscription price, U. S. A.—$2.40 yr. (postage free); foreign, including Canada—$2.90 yr.

A new publication which made its initial appearance in April 1945, the Polymer Bulletin was established "to provide a medium for the dissemination of information on trends, developments and research in the rapidly growing field of high polymers." Editorial plans are to include, as well, summaries of seminars and symposia at the Institute along with news items and papers contributed by readers.

Topics covered in the first issue, which is well illustrated, are "The Bureau of High Polymer Research," "The Method of Polymerization in Suspension," "Viscosity-Molecular Weight Relation for Cellulose Acetate in Acetone," and lecture notes on "Molecular Size Distribution in Linear High Polymers," "Structural Properties of Natural and Synthetic Fibers," "Theory of Flow in Liquids and Solutions."

★ TWO DISTINCT TYPES OF FREAS temperature control cabinets are described in the 48-page Catalog 325 of Precision Scientific Co., Chicago 47, Ill. Gravity convection cabinets, lower in price and simpler in construction, have a slower rate of heat transfer and are adaptable where slow heat treatment is indicated. Mechanical convection cabinets, equipped with a motor-driven turboblower for controlled heat transfer, are said to be preferable where uniformity of temperature and speed of operation are essential. Under these two main headings come numerous general purpose ovens, hazard-safe cabinets, incubators and special-built equipment, as well as cabinets for specific uses such as plastic pre-heating, paraffin embedding and low temperature storage.

★ COMPLETE DETAILED INFORmation on corrosion resistant equipment is presented by Haveg Corp., Newark 28, Del., in Bulletin F-4 which might serve as a designer's handbook. Blueprints, tables and photographs supplement the text. Equipment shown is for use in the chemical, textile, metallurgical and petroleum industries, in particular.

★ EXPANSION TYPE STEAM generators which are said to be entirely self-contained and easy to install and operate are described in a recent catalog published by Clayton Mfg. Co., Alhambra, Calif. Also included are fuel consumption for oil and gas-fired types and complete specifications for all models.

★ A 24-PAGE MANUAL OF PILOT valves has been received from Vickers, Inc., Detroit 32, Mich. Generously interspersed with blueprints, diagrams, charts, specifications and photographs, the booklet displays a complete line of rotary and plunger type valves manually, mechanically or electrically operated.

★ PARKER-KALON CORP., NEW York, N. Y., has recently published the 6th edition of its catalog of self-tapping screws, socket screws and other fastening devices. New information and illustrated instructions on where and how to use the various types of screws have been added.

★ DURABONDED COATED ABRAsives, product of Behr-Manning, Troy, N. Y., are described in a new folder just released. The new type abrasive is said to increase cutting life of disks.

★ A CATALOG OF LAMINATING machines has been released by John Waldron Corp., New Brunswick, N. J. The many types of coaters and laminators are shown in a series of photographs. The accompanying text explains uses, special features, required properties of a laminated sheet and processes involved.

★ COMPLETE DATA ON engineered electrical insulating materials is given in the 28 pages of Bulletin ED44 just issued by Continental-Diamond Fibre Co., Newark, Del. The subject matter includes comparisons of the properties of various insulating materials, and forms, information on fabrication, specification and design data and a table of standard sizes. Much attention is devoted

to tests of power factor, dielectric constant and loss factor, dielectric strength, insulation and arc resistance, physical strength and the influence of water, temperature and frequency.

★ WATSON-STILLMAN CO., Roselle, N. J., has just released Bulletin No. 640-A on its high speed semi-automatic compression molding press. The machines may be operated as straight compression units or may be converted to transfer molding by the addition of a top transfer cylinder. When one of these presses is sold as a compression molding machine, the top platen is machined so that a transfer cylinder may be added if desired. Illustrations and blueprints complete the discussion.

★ THE FIRST EDITION OF THE Fiberglas Bibliography with annotated references to selected articles has been received from Owens-Corning Fiberglas Corp., Toledo, Ohio. The book was compiled as an aid to reference librarians, technologists, engineers, students and others interested in obtaining ready access to data published in periodicals and books of general circulation, about the properties, manufacture and varied uses of Fiberglas materials.

★ SUPERIOR TYPE CO., CHICAGO, Ill. has published a spiral-bound brochure offering a comprehensive guide to industrial marking of cylindrical, hexagonal, conical and flat surfaces by means of rotary machines, automatic machines, hand rollers and other methods. Marking inks, rubber dies, type and logotypes are included in the subject matter.

★ ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., has released a new Bulletin, B6351, on single-suction pedestal-type centrifugal pumps, giving cross-sectional drawings of the pedestal types and standard specifications with dimensions illustrated and tabluated.

★ "THE MIRACLE OF PLASTIC Coating" is outlined by Cleaveland Laboratories & Mfg. Co., Inc., Peapak, N. J., in its booklet of that title which suggests postwar uses for coatings in industry, as well as in the home.

★ AN ATTRACTIVE BOOKLET illustrated in four colors and showing the work of the plastics divisions of General Electric Co., Bridgeport 2, Conn. has been received from that company. The pamphlet is divided into sections on chemistry, designing, engineering, mold-making and manufacturing.

★ A BULLETIN JUST RELEASED by American Phenolic Corp., Chicago 50, Ill., describes its products Polyweld "912" and Acryweld "901" with emphasis upon electronic and waterproofing characteristics. The former is intended for use as a liquid coil dope with "912-A" polystyrene products, the latter as a cement or thinner with "912-B" acrylic products. Electronic engineers, radiomen and radio amateurs may have the booklet at no cost.

★ COTTON BUFFS AND POLISHING wheels made by MacFarland Mfg. Co., Inc., Long Island City, N. Y., and Airway ventilated buffs, product of its associate company Jackson Buff Corp., Long Island City, N. Y., are shown in illustrated circulars from the two companies.

★ A COMPREHENSIVE GUIDE TO the use of Rosán locked-in threaded inserts and studs is provided in the 24-page brochure offered by Bardwell & McAllister, Inc., Hollywood, Calif. The information covers engineering standards, service and design data. An animated drawing on the inside cover tells more graphically than could words the manner in which the inserts are locked in.

★ "HERCULES CHEMIST," NO. 14, a 25-page booklet by Hercules Powder Co., Inc., Wilmington, Del. presents useful and interesting information on nitrocellulose lacquers with high solids, Clorafins, pine oils, glycol-ester resins and other recent developments of this company. Sketches, photographs, numerous charts and tables are used to emphasize the important properties of each of these materials.

★ "LOOKING AHEAD WITH Teckna Company" outlines the postwar plans of Teckna Co., Bayside, N. Y., describing its new plant, production facilities and the wide variety of its products in 12 pages of text and photographs.

★ "NATURAL AND SYNTHETIC Rubber Adhesives," a pamphlet received from B. F. Goodrich Co., Akron, Ohio, tells the facts about rubber cement—methods of applying these cements, means for choosing the right kind of adhesive and suggested cement applications. Data on cement weights, colors and base materials are also included in the booklet.

★ "BEAUTY AND UTILITY IN Plastics and Metals," catalog of Electric Auto-lite Co., Bay City, Mich., displays in four colors ways in which plastics and metals are utilized in the automobile industry. Ornamentation of metals, rolled and formed metals, functional plastics, ornamental plastics, rubber-like plastics and plastic and metal combinations are among the topics covered.

★ "THE FIRST EQUIPMENT GUIDE to Industry, Catalog 45," published by First Machinery Corp., New York, N. Y., contains 96 pages of data on equipment and complete plants for the process industries. Profusely illustrated, the catalog covers machinery for such diversified fields as rubber, synthetics and plastics; cosmetics, drugs and pharmaceuticals; and foundries. Tables and useful information for engineers are given.

★ FOUR CIRCULARS HAVE BEEN received from Sundstrand Machine Tool Co., Rockford, Ill., describing Model 1000 pneumatic sanding machine, Model 3000 sanding and rubbing machine, heavy-duty pneumatic machine, and attachments for all machines and suggestions for finishing.

★ A QUICK GUIDE TO CUTTING tools is furnished by Chicago-Latrobe Twist Drill Works, Chicago 10, Ill., in its new leaflet. Specific mention is made of the materials on which each type of drill produced by this company performs satisfactorily, and the kind of work for which each is best suited. The range of sizes in which the tools are manufactured is given.

★ INDUSTRIAL X-RAY UNITS FOR low voltage work are discussed in a bulletin from Picker X-Ray Corp., New York, N. Y. Among the uses given for these units are inspection of materials having a relatively low density, such as plastics, plywood leather, glass, paint and varnish; spot-weld control; and microradiography.

★ INSTRUCTIONS FOR LOADING, setting up and operating the new 32-brush Vonnegut brush-backed sander head are contained in Bulletin No. 52 of Vonnegut Moulder Corp., Indianapolis, Ind. Pictures and text combine to give the reader a step by step picture of the operations involved in the loading and setting up of a unit.

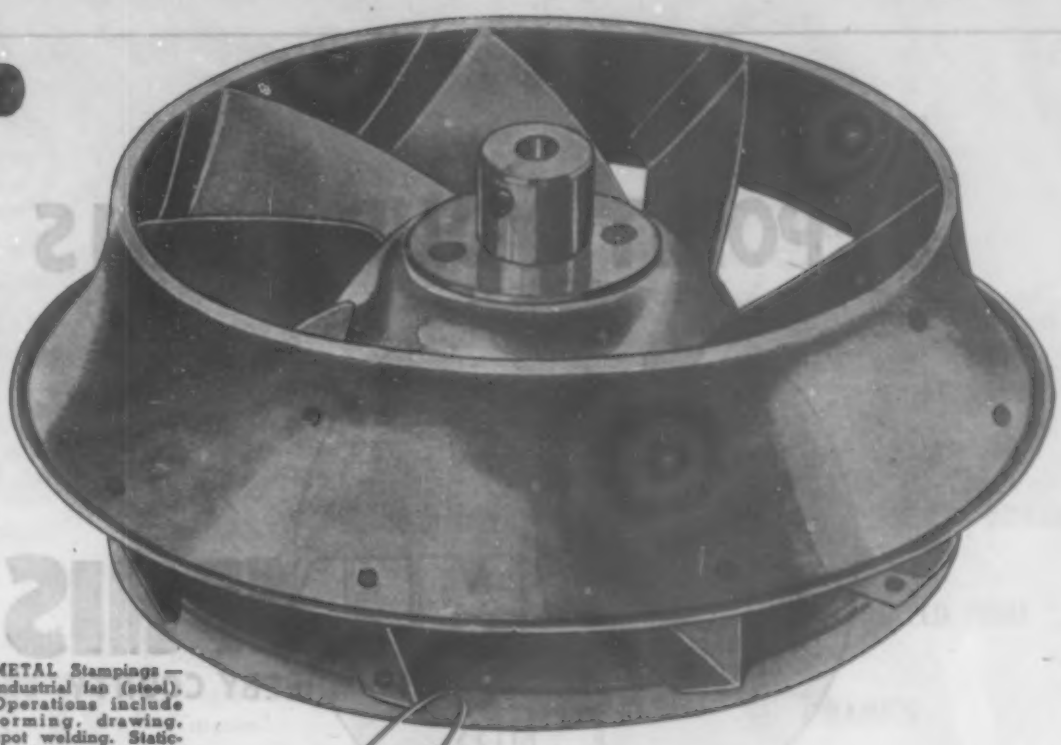
★ EXTRUDED PLASTICS IS THE subject of a 40-page brochure prepared by Sandee Mfg. Co., Chicago 18, Ill., in which a discussion of processes, equipment and materials is supplemented by informative tables and charts. Fifteen illustrated pages show stock and custom sections.

★ THE KINDT-COLLINS MASTER hydraulically operated 30-in. disk grinder is described in some detail in a bulletin received from Kindt-Collins Co., Cleveland 7, Ohio. Specifications are given for two models, Model 30-L and 30-H.

★ ELECTRIC TIMER BULLETIN, No. 1100, just released by C. H. Stoelting Co., Chicago 24, Ill., contains descriptions and illustrations of table model stop clocks, wall model stop clocks, precision chronoscopes, combination timers and impulse counters, stop watch controllers and spring wound x-ray timers.

★ THE REVISED "MANUAL ON Assembly Gluing," General Information No. 3, has been received from the Resin Adhesive Sub-Committee of the Society of the Plastics Industry, New York 17, N. Y. With the furthering of better shop practices as its aim, the new edition offers up-to-date information and drawings on the use of resins in the gluing of parts.

PLASTIC injection molded. A commercial application of assembled plastics.



METAL Stampings — industrial fan (steel). Operations include forming, drawing, spot welding. Statically balanced.

Complete service

PLASTIC MOLDING
METAL STAMPING
PLASTIC *with* METAL

America's largest Industries are benefiting by our experience in both Plastic Molding and Metal Stamping. The METAL SPECIALTY CO. offers you this unique service combination. Our alert experienced Engineering and Designing staff keeps abreast of the rapid changes in material and production methods, for both Metal Fabricating and Plastic Molding.

PLASTIC MOLDING DIVISION . . . **All thermoplastics from a fraction of an ounce up through 18 ounces per shot.**

METAL FABRICATING DIVISION . . . **In all heavy and new light metals. Drawing. Coining. Stamping. Welding. Rolling. Forming.**

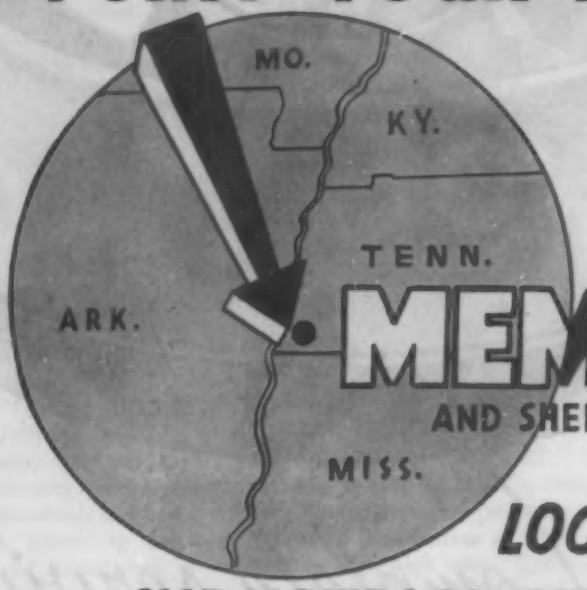
THE METAL SPECIALTY CO

PLASTIC MOLDING
METAL STAMPING

ESTE AVE. · CINCINNATI 32 · OHIO

BRANCH PLANT — SOUTH L ST., RICHMOND, IND.
SALES OFFICE — W. GRAND BLVD., DETROIT, MICH.

POINT YOUR PLANS



to

MEMPHIS
AND SHELBY COUNTY

LOCATE FOR
INDUSTRIAL ADVANTAGES

- **STRATEGICALLY LOCATED** — With exceptional rail, truck, water and air facilities.
- **ATTRACTIVE INDUSTRIAL SITES**— Large areas zoned in various sections of city and county for industrial purposes.
- **HYDRO-ELECTRIC POWER — NATURAL GAS — PURE ARTESIAN WATER** — Municipally owned —operated at low rates.
- **FAVORABLE LABOR RELATIONS**—About 90% population native born. Relations of labor and management highly cooperative.
- **LOW TAXES**—Efficient, honest city and county government, cooperative with business and industry.
- **RESOURCES** — Close to mineral, timber, and agricultural resources.
- **MILD CLIMATE**—Provides most favorable working conditions for skilled and unskilled labor.
- **FIRST IN HEALTH** — City and county health programs have won top awards for five successive years in nation-wide campaigns.

MEMPHIS
AND SHELBY COUNTY

A Great Place to Locate ★ A Great Place to Live

WRITE FOR "1944 INDUSTRIAL SURVEY OF MEMPHIS," ALL NEGOTIATIONS CONFIDENTIAL

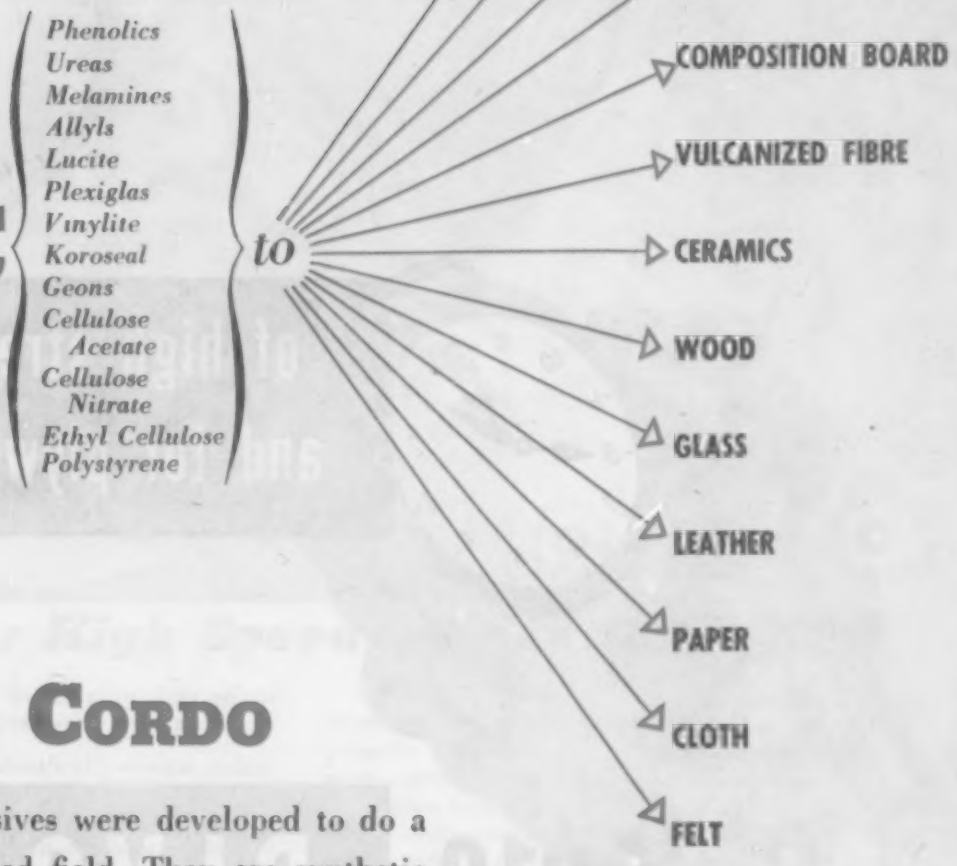
address

Walter Chandler
MAYOR OF MEMPHIS

or

E. W. Hale
CHAIRMAN SHELBY COUNTY COMMISSIONERS

IF YOU WANT TO BOND A PLASTIC



Call in CORDO

CORD-BOND Adhesives were developed to do a job in this specialized field. They are synthetic plastic adhesives. They provide high-strength, permanent bonds for mass production applications.

Various formulations of CORDO-BOND Adhesives cover a wide range of materials, product uses and bonding methods.

Write . . . giving exact details of your problems, for analysis, recommendations.

CORDO CHEMICAL CORPORATION
34 Smith St., Norwalk, Conn.

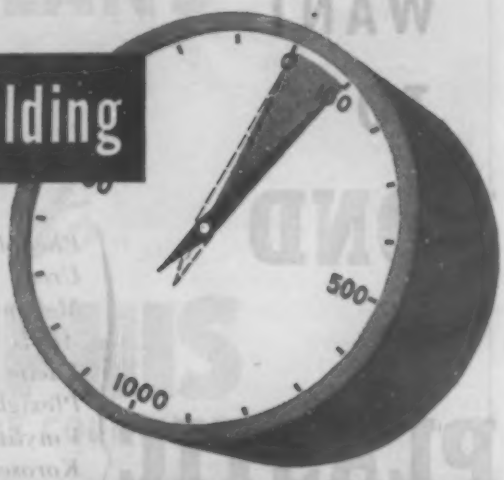
INDUSTRIAL COATINGS • FINISHES
INDUSTRIAL ADHESIVES

CORDO-BOND

WORLD'S LARGEST PRODUCER OF SYNTHETIC RESINS

RCI

for fast-curing • low-pressure molding



# of high strength paper and for plywood overlays

No. 5013 PLYOPHEN

High pressures are unnecessary—when No. 5013 Plyophen is used. With this low-cost varnish, either paper or canvas stock can be cured at pressures of only 100 to 250 lbs. psi. This RCI product, especially developed for fast-curing, low-pressure molding, is particularly recommended for use with the newer types of high strength papers. In these applications exceptionally high tensiles are obtained and only about 32 to 35% resin on the paper is necessary. Plywood surfaced with paper impregnated with No. 5013 Plyophen produces a new type of material for many applications. This widely useful phenolic varnish also makes possible the use of wood formerly considered unsuitable for face veneers. For full technical information on No. 5013 Plyophen write to the Sales Department in Detroit.

Saturday Evenings at 8:30 (E.W.T.)
You Will Enjoy RCI's
"Symphony of the Americas"
Via Mutual Network Stations

REICHHOLD CHEMICALS, INC.

General Offices and Main Plant, Detroit 20, Michigan

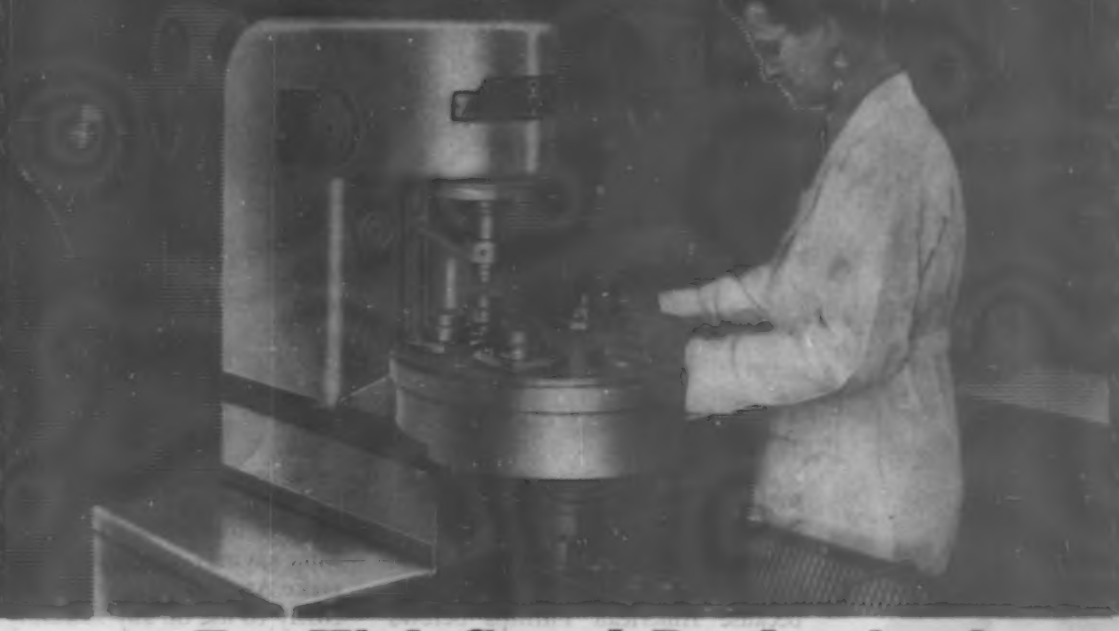
Other Plants: Brooklyn, New York • Elizabeth, New Jersey • South San Francisco, California • Tuscaloosa, Alabama • Liverpool, England • Sydney, Australia

SYNTHETIC RESINS • CHEMICAL COLORS • INDUSTRIAL PLASTICS • INDUSTRIAL CHEMICALS

The 4-Ton Production Giant in Midget Form

MULTIPRESS

With Indexing Table



-- For High Speed Production !

Here's the way to increase production of small parts—at low cost—and with precision.

A six-station hydraulically-driven indexing table is one of the many standard accessories which make MULTIPRESS a versatile, production giant. Speeds of these tables are adjustable anywhere between 10 and 50 indexes per minute. Ram and table operate in positively interlocked sequence. Length of ram stroke, ram speed, and speed of table determine number of complete cycles per minute. They literally multiply production on continuous pressing and assembling operations requiring up to 4-ton pressures—with accuracy of operation and safety for the operator, no matter how unskilled he may be. Maximum pressure to be exerted upon the work can be limited at any point between 1600 and 8,000 pounds by a simple adjustment.

Multipress is a fully self-contained, motor-driven, oil-hydraulic machine tool—an easily portable unit, delivered ready to connect to your electric power source. The basic unit (as shown below) is only 16 inches wide, 26 inches deep, and 34 inches high. Its rugged frame, already drilled and tapped for attaching the index table, also provides for the addition of many other standard accessories. Among these are benches, extension tables, side shelves, a variety of bolster plates, straightening fixtures, automatic cycling controls, ram speed controls, and Vibra-Pres control which affords any number of short, exact-pressure, repeat strokes upon each full downstroke of the ram—the number of those strokes regulatory from a few to practically vibration.

Write for complete information.

The Denison Engineering Company, 1176 Dublin Rd., Columbus, Ohio

DENISON
EQUIPMENT for APPLIED
HydrOILics

SELECT THE RIGHT HAND

"I Finish More Work by Noon with AMERICAN PHILLIPS SCREWS THAN I DID IN A WHOLE DAY WITH SLOTTED SCREWS!"

50% FASTER . . . that's the average speed-increase wherever modern American Phillips Screws replace outdated slotted screws. And that's because American Phillips Screws prevent driver-slippage, which means power drivers can be used on any job. So these straight-driving, fumbleproof screws take the brakes off your workers' hands, and the strain off their nerves and muscles. Self-confidence and pride in work is built up . . . and so is output and product quality, for there's no more scarred work or burred, broken screw heads. Time-savings alone are enough to make American Phillips Screws least costly to use on any assembly job in small shop or big plant. But there's another saving that comes from American's own system of quality control and individual 3-point inspection that give you higher "perfection-percentage" in every order. Try American Phillips Screws yourself . . . and see what happens to what you thought were *fixed costs!*

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois Street **Detroit 2: 502 Stephenson Building**

PUT THE SCREWS ON THE JAPS . . . BUY WAR BONDS

AMERICAN PHILLIPS Screws

CONTINUOUS LENGTH EXTRUSION OF THERMOPLASTICS

and what it means to you

Just what does the process of continuous dry extrusion of plastics mean to you?

It is one of the newest processing methods in the plastics industry. It has grown tremendously within a very few years. The size of the machinery available and the application of the materials are constantly expanding.

As a rapidly expanding process, dry extrusion indicates itself as one whose output is needed by more and more industries. Extruded insulation, tubing, aircraft parts and other applications, are being used in tremendous quantities.

Post-war, they promise to continue to grow. Such varied fields as automobiles and furniture have found many uses for extruded plastics.

As the first to perform this process commercially and still a leader in the field, MACOID offers its facilities for engineering and manufacture of extruded plastics to all industries.

We also do injection molding.

DETROIT

MACOID

CORPORATION

12340 Cloverdale Ave.

Detroit, Michigan

SOCIETY OF THE PLASTICS INDUSTRY · SPI

ORIGINATORS OF
DRY PROCESS PLASTIC EXTRUSION

"World Traveler"

This General American car has traveled the equivalent of ten times around the world—carrying Navy fuel oil safely and speedily. Its record of dependability is equaled by thousands of General American tank cars serving all types of industry. Each GATX car is designed with protective features for specific liquid commodities. Wartime performance of the GATX fleet indicates its peacetime value to you for most efficient transportation of any bulk liquid.

For Your Postwar Products

Your company may be developing liquid commodities never shipped in bulk before and difficult to handle. General American will plan with you now the tank cars to carry your products economically.

Builders and Operators of Specialized Railroad Freight Cars
Bulk Liquid Storage Terminals
Process Equipment of All Kinds
Pressure Vessels and Other Welded Equipment
Aerocoach Motor Coaches
Processing Service for Fruits and Vegetables

GATX
GENERAL AMERICAN

GENERAL AMERICAN TRANSPORTATION
CORPORATION
CHICAGO

How to make BIG plastic parts seem LITTLE

Radio cabinets, housings, washing machine agitators and such—all the larger and more complicated pieces we used to mold before the war—all will go on the production schedules of smaller, simpler pieces when we get into normal production again. They will have better finishes, more uniform cure, truer color and freedom from internal stress. In other, shorter, words, "Happy Day!"

All we'll have to do is hook up our battery of Heatronic units (*first* in the industry—and still growing) to serve our 500-ton presses.

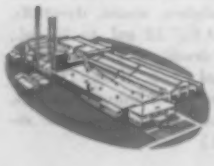
Better start figuring now on how Plastics plus Heatronics can fit into *your* postwar production plans. But figure it with a custom molder whose reputation for molding already combines with real Heatronics knowledge—a molder like Kurz-Kasch. We mold all materials by compression and transfer—we handle the whole job from design to delivery—our experience with Heatronics dates back to the first unit RCA sold—and we've been growing with the plastics industry since it began.

Isn't that the kind of organization you'll want for your plastics production? Yes? Just write!

"A Businessman's Guide to the Molding of Plastics"

Send for your free copy of this illustrated brochure. Just write to Dept. 7 on your letterhead and we'll send it with our compliments.

Kurz-Kasch



For over 28 years Planners and Molders in Plastics

Kurz-Kasch, Inc., 1415 South Broadway, Dayton 1, Ohio. *Branch Sales Offices:* New York • Chicago • Detroit Indianapolis • Los Angeles • Dallas • St. Louis • Toronto, Canada. *Export Offices:* 89 Broad Street, New York City

"The bigger the family—the better the service"

THAT'S a fact in any well-run family! And no family's better equipped to meet *your* packaging needs than Continental. Extensive resources and facilities plus technical skill and long experience will solve *your* container question. Our experts will analyze it impartially.

Continental now covers every phase of packaging—metal containers, liquid-tight paper cups and containers, fibre cans and drums, steel pails, various heavy duty containers.

Right now we're busy meeting Uncle Sam's needs. But keep your eye on Continental! And on Continental's trademark, too! The Triple-C stands for one company with one policy—to give you only the best in quality and service.

Tune in: "REPORT TO THE NATION" *every Sunday over coast-to-coast CBS network*

Continental Fibre Drums—Continental makes a full line of sturdy fibre drums, both the all-fibre and the metal-end types, for shipping dry bulk products, dry paint, flaked or powdered chemicals, resins, viscous greases, asphalt, pitches, waxes, dyestuffs. Our drums are "LEVERPAK," 12 gal. to 75 gal., "FIBERPAK" (an all-fibre drum), ½ gal. to 67 gal., "STAPAK," 2 gal. to 32 gal., and "KEYSTONE," 10 gal. to 55 gal. Wide selection of linings, coatings, treatments and constructions to meet specific requirements.

CONTINENTAL

C PAPER DIVISION

CAN COMPANY, INC.

FIBRE DRUMS The Container Co., Van Wert, Ohio

LIQUID-TIGHT FOOD CONTAINERS — Boothby Fibre Can Co. Roxbury, Mass.

PAPER CUPS AND FOOD CONTAINERS — Mono Containers Newark, N. J.

COMBINATION PAPER AND METAL CONTAINERS

Headquarters: 330 W. 42d St., New York 18, N. Y.

13 Plants — Sales offices in all principal cities

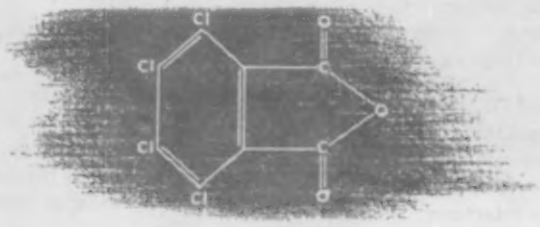
PRESENTING...

Niathal

TETRACHLORO PHTHALIC ANHYDRIDE

A NEW AND VERSATILE INDUSTRIAL CHEMICAL For Which A Manufacturing Process Has Been Developed

● NIATHAL* is fully chlorinated Phthalic Anhydride—all four hydrogen atoms being replaced by chlorine. The molecular structure of Tetrachloro Phthalic Anhydride may be represented as follows: The molecular weight of this compound is 285.9 and the chlorine content is 49.6%. It is made by a novel process for which patent protection is pending.



PROPERTIES—NIATHAL is an almost white, odorless powder. Its purity is greater than 99%, the remainder being chiefly chemically bound water. It is free-flowing and non-hygroscopic.

NIATHAL melts with very slight decomposition at 254-255°C (255°C = 491°F), as against 254.9°C for the 100% pure compound. It has an appreciable vapor pressure at elevated temperatures and particularly above its melting point. It boils at approximately 362°C (684°F).

Although our own experience indicates that NIATHAL is non-irritating and non-toxic, we recommend suitable precautions when using it for making new compounds and products.

SOLUBILITY—100 parts of water dissolves with difficulty up to 0.33 parts of NIATHAL at 20°C and about 1.6 parts at 90°C, forming the corresponding dibasic acid. A pH of about 2.0 characterizes this solution.

With caustic soda or caustic potash solutions NIATHAL readily forms the neutral alkali salts, both of which are highly soluble; about 35% aqueous solutions of these salts may be obtained at 65°C. These salts, as well as the slightly soluble acid salts, form crystalline solids. NIATHAL forms nearly insoluble salts of several common metals.

NIATHAL is soluble in several organic solvents. For example, 2 to 6% solutions may be obtained at room temperature in Acetone, Benzene, and Chlorobenzene. Solubilities materially increase with elevation of temperature.

USES—Since Phthalic Anhydride has found extensive use in numerous synthetic organic chemical industries, it is predicted that the chlorinated product will also find large and varied outlets. The introduction of almost 50% chlorine into the molecule yields new and interesting properties. The chemical structure is highly stable. This fact, in combination with high melting point, suggests that compounds made from NIATHAL may be used at more elevated temperatures. High chlorine content also improves resistance to fire.

NIATHAL is suggested for use as an intermediate or compounding material in the manufacture of...

DYES • ESTERS • SYNTHETIC RUBBERS
PHARMACEUTICALS • PLASTICIZERS • INSULATING MATERIALS • FUNGICIDES • PROTECTIVE COATINGS • LUBRICANTS • SYNTHETIC RESINS.

SHIPPING CONTAINERS—NIATHAL will be shipped in fiber containers or paper-lined wooden barrels of various sizes. It is at present available only in experimental amounts. Sample on request.

*Trade Mark Registration applied for

Niagara ALKALI COMPANY

"An Essential Part Of America's Great Chemical Enterprise"

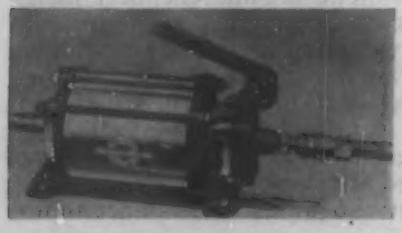
60 EAST 42nd STREET, NEW YORK 17, N. Y.

CAUSTIC POTASH • CAUSTIC SODA • PARADICHLOROBENZENE • CARBONATE OF POTASH • LIQUID CHLORINE

NEW MACHINERY AND EQUIPMENT

★ GROBET FILE CO. OF AMERICA, New York 13, N. Y., has announced the addition of twin-fluted countersinks to its line of chatterless countersinks. These fast cutting tools, for which patents have been applied for, are recommended for use with plastics, plywood, aluminum, magnesium and steel. They are said to give a smooth micro-inch finish and to be adaptable for a coarser type of work such as brake linings.

★ "BIG BROTHER" TO THE BELlows BM5 air motor, the BM10 recently produced by Bellows Co., Akron 10, Ohio, develops more than twice the piston thrust force of the smaller motor on a given air line pressure. The same basic principle of integral valves, operating and



speed controls is retained, making the motor adaptable to varied operations including opening and closing rubber or plastic molds, powering turret beds, feeding drill presses and operating steel and abrasive cut-off saws.

★ A DISPLACEMENT PUMP OF the screw type which is suited to most heavy-duty pumping has been introduced by Sier-Bath Gear Co., North Bergen, N. J. The pump will handle thick liquids of both the lubricating and non-lubricating type, such as asphalt, greases, soaps and syrups. There is no pulsation or vibration in the flow from the pump, it is claimed, and hence no loosening of piping as a result of the impact of a pulsating flow.

★ FEDERAL TELEPHONE AND Radio Corp., New York 4, N. Y., has announced a Megatherm for high-frequency heating of a wide range of dielectric materials which has a nominal output of 1 kilowatt. Compact in design and portable, the new model MD-1A, developed by the Industrial Electronics Division, is said to be suited for preheating of plastic preforms, as a basic unit for incorporation into molding presses or into special production set-ups. It is equipped with a foot-pedal switch for opening the oven door, a single or double push button for application of power to the work and a foolproof automatic timer for controlling the duration of the heating cycle. The unit may be installed at any 220 volt, single-phase 60 cycle AC outlet and supplies 3500 B.t.u. per hour at its operating frequency of 27 megacycles.

★ B. F. GOODRICH CO., AKRON, Ohio, has announced a new splined Rivnut for use in plastics, wood, leather, hard rubber or other material where a nut for attaching accessories must be firmly anchored. In this type of Rivnut, splines beneath the countersunk head supply resistance to torque and the bulge or "upset" which forms below the end of the splines furnishes the tension resistance. Thus the Rivnut is locked in place in two ways. Originally developed by the company for use in the aviation industry, the Rivnut line is now being adapted to many fields including aircraft, automotive, refrigeration and electrical equipment. They come in aluminum and brass in three sizes.

★ DANGEROUS AND OBNOXIOUS dusts arising from buffing, polishing or grinding machines can be removed from the air by the tubular Dustex dust collector, according to the manufacturer, Dust Filter Co., Chicago 1, Ill. Self-contained and portable, the units are available in three sizes. The largest collector contains 60.8 sq. ft. of filter surface, the smaller units proportionally smaller surface areas. No collector bags are used. The filter surfaces are tubular in design and are bottomless. Dust filtered through them is collected in a pan at the bottom of the unit. These are shaken periodically by a handshaker thus eliminating the necessity of opening the machine for the purpose of cleaning.

★ PLASTIC SHEETS SPECIALLY processed from Vinylite for accurate drawings and close tolerance reproduction have recently been developed by Direct Reproduction Corp., New York 16, N. Y. A new system of templet or flat pattern reproduction on a direct contact basis, which is said to eliminate the need for darkrooms and large developing tanks, is employed with these sheets. This is accomplished by using an emulsion suitable for work under artificial light. Original drawings are made on "Dyrite" and reproductions for templets can be made directly from them.

★ AN ALL-PURPOSE CABLE CLAMP recently developed by Glenn L. Martin Co., Baltimore, Md., permits the breaking load of any cable to be accurately and quickly measured, thus avoiding damage at the crimped point and a consequent false breaking point. The main feature is a dual pulley whose diameter is such that tension on the cable is relieved and only a small part of the strain is borne by the clamp. An automatic locking bolt replaces some 12 hand-adjusted bolts found in some earlier types of cable clamps.

★ WAR-TESTED BY VARIOUS branches of the Armed Forces, PiB, liquid insulation product of U. S. Industrial Chemicals, Inc., New York, N. Y., has recently been made available to the general public, according to a release from the manufacturer. This new liquid, it is said, will find use as a waterproofing agent on ignition systems and for the prevention of corrosion and current leakage in batteries. It can also be used to re-insulate cracked, worn or dried-out wiring and acts equally well as a rust inhibitor.

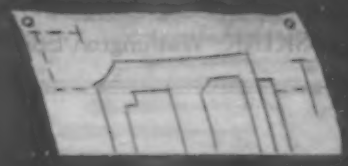
★ PRECISION SCIENTIFIC CO., Chicago 47, Ill., has developed a new polarizer for determining the amount of strain produced by fabrication or mechanical manipulation of transparent rigid and non-rigid plastic materials. In this unit a source of illumination is diffused through

opal glass for uniformity, two polaroid sheets being placed above the light and sandwiched between clear glass. The upper glass section is adjustable through a distance of approximately 8 inches. Identification of transparent plastics is said to be possible with the polarizer.

★ THE SURF-CHEK ROUGHNESS Standards kit, product of Surface Checking Gage Co., Hollywood 28, Calif., is designed to meet the trend toward ever-increasing uniformity in surface control. Contained in the kit is a 65-page educational text bound to a gage consisting of 20 replicas of machined surfaces, prepared by turning, grinding, milling, honing, lapping and polishing, which vary in roughness from 500 to 5 micro-inches. This method of designation is said to eliminate guess work in interpretation.

Another Plastic Success Story . . .

This electrical switch gear section was brought to TECH-ART by a leading manufacturer of electrical equipment. Even in simplified form, the design required more than 300 molded surfaces, with fillets, chamfers, inserts and sections of varying thickness to complicate the mold. Made to fit in with an assembly of other plastic parts, each of its 300 surfaces had to be molded to precise tolerances. TECH-ART engineers produced the mold design—TECH-ART mold builders made the mold—and the accurate pieces that resulted are now another chapter in Plastic Success Stories by TECH-ART.



An Electrifying Idea . . . Molded in PLASTICS

Fitting this complicated piece into the electrical industry illustrates an additional ability of TECH-ART engineering—not only to contribute sound engineering judgment where it is possible to simplify a new design idea, but to translate accurately those ideas which *cannot* be readily simplified. TECH-ART engineers never hesitate to follow a necessary complex design, because TECH-ART mold builders have the skill and experience to reproduce complex patterns with precision accuracy in every detail. And once the finished mold is turned over to production, TECH-ART's wide molding facilities give full assurance that your finished product will be just what you envisioned in dimensional tolerances, physical appearance, and serviceability.

TECHNICAL NOTES — *Because of its complex nature, this piece had to be produced on a compression-transfer mold. Plastic used is a high-dielectric material, providing the required electrical characteristic.*

36th Ave. and 41st Street • LONG ISLAND CITY, N. Y. • Tel. AStoria 8-6050-1

SUCCESSORS TO BOONTON RUBBER MANUFACTURING COMPANY

PIONEER PLASTIC MOLDERS . . . Established 1891

TECH-ART PLASTICS COMPANY

WASHINGTON ROUND-UP

R. L. VAN BOSKIRK, Washington Editor

Wave band for electronic heaters

The plastics industry has failed to obtain a greatly enlarged wave band for the operation of electronic heaters, according to a press release issued by the Federal Communications Commission on May 17.

The press release states: "The band in the 27-megacycle region available for scientific, industrial and medical devices, including diathermy machines, was enlarged in accordance with the recommendation of the manufacturers of diathermy machines, from the 30-kilocycle channel width assigned in the proposed report to 270 kilocycles. The other allocations for the scientific, industrial and medical devices were left unchanged." (These "other allocations" were in the 13- and 40-megacycle regions in the proposed allocation which was discussed at the March 1945 hearing. These narrow channels were wanted for special operations.)

However, the plastics industry had asked for a wave band 4000 kilocycles in width in the 27-megacycle region in order that they might use present equipment and avoid excess shielding. The increase from the 30 kilocycles originally proposed to the 270 kilocycles granted was the increase requested by diathermy operators—industrial users wanted a much broader band to operate efficiently and without interference to other spectrum users.

A spokesman for the FCC told this correspondent that the Commission members did not feel they could take the requested amount of space desired by industrial users out of the spectrum without injustice to other users. Furthermore, he declared that industrial users operate on a large scale and can afford the necessary expense involved in the prevention of interference.

A detailed report on the Commission's action is expected later.

Cellulose acetate molding powder

At a meeting of the Cellulose Acetate Molding Powder and Sheeting Producers Industry Advisory Committee on May 7, industry members recommended that cellulose acetate molding powder allocations continue to be made by the method in which molders file end use certificates with suppliers, and suppliers file Form WPA 2947 with the War Production Board, rather than returning to the method in which the molders file 2945 with WPB and the suppliers file 2946. However, it was felt that only military uses should be listed on 2947 and request should be made for civilian cellulose acetate molding powder under Paragraph (f), thus eliminating the 8 civilian preferential categories which have been used for the last three months.

Review of allocations of cellulose acetate molding powder for these essential end uses shows only 739,000 lb. in March; 553,000 lb. in April; 833,000 lb. in May. These were small quantities compared to the total available for civilian use, and therefore it is felt that these needs would be adequately taken care of under the Paragraph (f) procedure. It is interesting to note that of the above amounts, toothbrush handles received allocations of 300,000 to 390,000 lb. per month. The OCR and the Plastics Branch have now decided that the toothbrush supply is adequate.

Because of the high military demand for cellulose acetate butyrate molding powder, it was felt that for this, material suppliers should continue listing the essential civilian items covered by the 8 categories on Form 2947.

Production of cellulose acetate molding powder has been maintained at a rate of 3,500,000 to 4,000,000 lb. per month since last September. Military demands during the same period increased from 800,000 lb. in September to 1,800,000 in March, since which time they have declined slightly. Approximate poundage of military allocations for each month were: September, 800,000; October, 800,000; November, 900,000; December, 1,000,000; January, 1,600,000; February, 1,700,000; March, 1,800,000; April, 1,600,000; and May, 1,300,000.

Plasticizers were also discussed at this meeting. It was estimated that phthalates will remain tight for from 6 to 9 months, depending upon military uses. If cutbacks made more phenol available, production of triphenyl phosphate might be increased. Although citrate may remain tight, there will probably still be sizable quantities of triacetin available.

Industry members stated that they prefer that distribution of phthalates or triphenyl phosphate which might become available for civilian use be left to their discretion, with amounts allocated on the basis of the monthly production of each manufacturer rather than on that of specified end uses.

Civilian goods reconversion

The situation in regard to availability of plastics for civilian application has not changed much since V-E day. The public has not yet been informed of any appreciable amount of cutback that would make plastics material available in greater quantities. All reports indicate that the Armed Services are reluctant to display their hand—perhaps there is still some uncertainty as to how much will be needed for conducting warfare in the Pacific. However, it is known that new applications are taking more and more of certain plastics raw materials and the chemicals from which they are produced and no one can tell what the over-all supply picture is like until military needs are known.

A summary of recent WPB orders that apply in some respects to the plastics industry are as follows:

Revocation of 61 orders from May 11 to May 18 include the following items, all of which contain plastics parts: Scales, vending machines, alarm clocks, office machines including typewriters, electrical fixtures, flashlights, closures.

Hardwood plywood and veneer are more critical than ever, and WPB representatives stated that it was doubtful that civilian supply this year would be more than half of that of 1944.

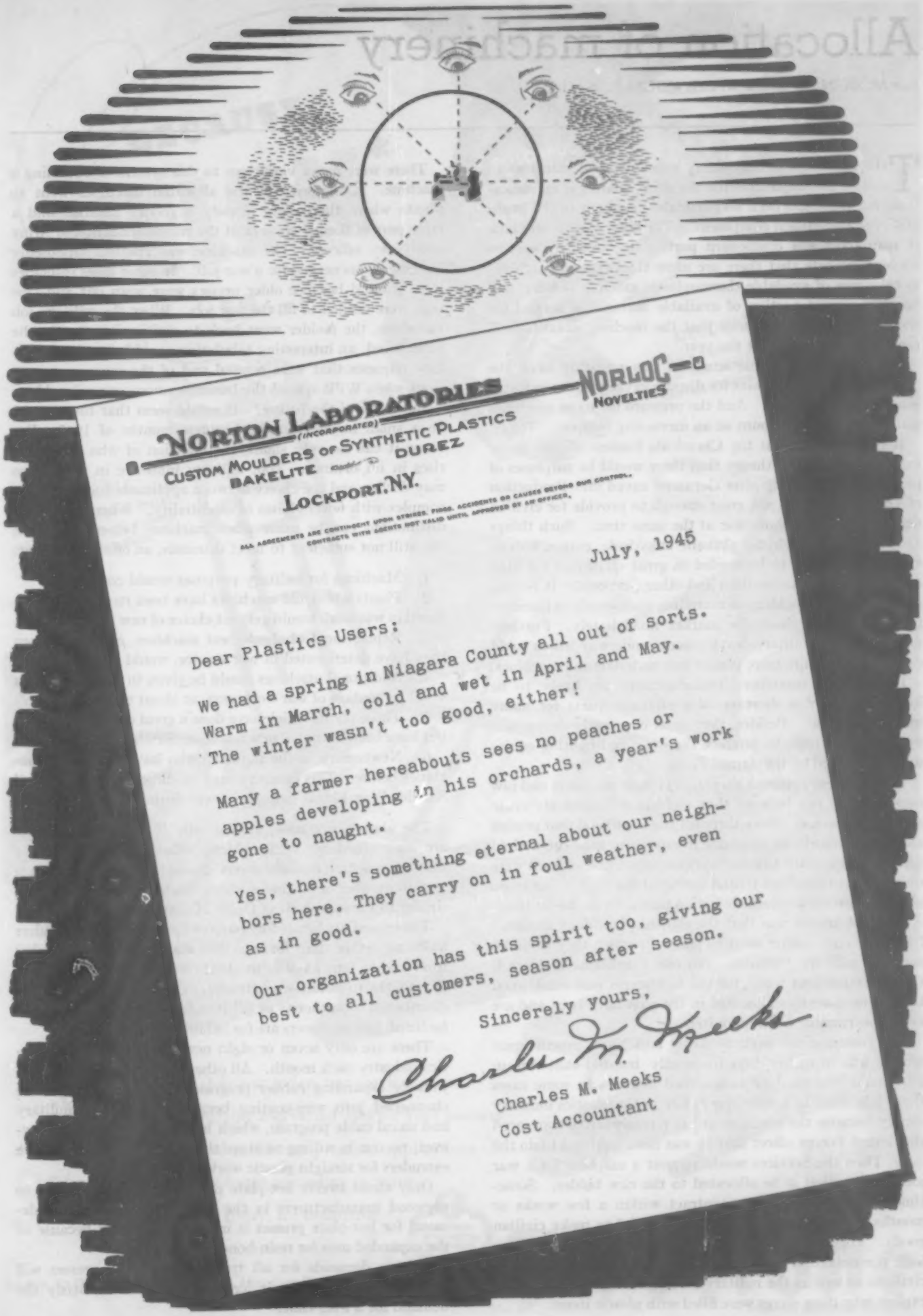
Production of lamp shades has been permitted, provided that no silk, phenolic plastics, nor metal other than iron and steel in wire frames is used. The quantities and types of plastics that may be available for lamps and shades vary from month to month, in accordance with fluctuating military demands for the various types of plastics.

Among the deterring factors listed by WPB as hampering the reconversion of the metal household furniture industry is the shortage of phthalic alkyd resins and phenolic resins. For two years 98 percent of production of the former, and much of the productive capacity of the latter has gone into military channels. Increased production of melamine and urea resins is hampered by manpower shortages. There is an ample supply of cellulose nitrate, but solvents are scarce.

The proposed resumption of domestic mechanical refrigerator reproduction meets the following stumbling block as quoted by WPB:

"Phenolic resin plastics are extremely tight because they require phenol, needed also for high octane gasoline and other urgent war programs. They may not be available in sufficient quantity for refrigerator parts such as knobs, shelf supports and trimming. Other types of plastics, however, are expected to be available in varying quantities, depending upon the availability of basic chemicals, in turn controlled by fluctuating military demands."

In naming the official list of materials which would remain scarce for an indefinite period, WPB included every known plastic material, practically all the chemicals used in plastic production, all important plasticizers and such auxiliary items as cotton linters, fibrous glass, and various other items used with plastics.



NORTON LABORATORIES
(INCORPORATED)
CUSTOM MOULDERS OF SYNTHETIC PLASTICS
BAKELITE DUREZ
LOCKPORT, N.Y.

NORLOC NOVELTIES

ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, FIRES, ACCIDENTS OR CAUSES BEYOND OUR CONTROL.
CONTRACTS WITH AGENTS NOT VALID UNTIL APPROVED BY AN OFFICER.

July, 1945

Dear Plastics Users:

We had a spring in Niagara County all out of sorts. Warm in March, cold and wet in April and May. The winter wasn't too good, either!

Many a farmer hereabouts sees no peaches or apples developing in his orchards, a year's work gone to naught.

Yes, there's something eternal about our neighbors here. They carry on in foul weather, even as in good.

Our organization has this spirit too, giving our best to all customers, season after season.

Sincerely yours,

Charles M. Meeks

Charles M. Meeks
Cost Accountant

Allocation of machinery

from MODERN PLASTICS WASHINGTON BUREAU

THE allocation of only thirty some injection machines to almost 200 applicants for the third quarter is an indication that there has been no particular easement in the availability of mechanical equipment. The bottleneck is still lack of manpower and component parts. Inasmuch as various surveys indicate that there are more than enough machines to take care of available thermoplastic molding powder, and because a great portion of available material is needed for war purposes, it is probable that the machine situation will remain tight throughout the year.

The injection machine situation has probably been the "hottest" continuous point for dispute in the plastics industry since early in the war. And the pressure for more machines can be expected to mount at an increasing tempo.

It is significant that top Chemicals Bureau officials never went along with the theory that there would be surpluses of practically everything after Germany caved in. Production of vital chemicals is not great enough to provide for civilian demands and an Asiatic war at the same time. Such things as benzol, formaldehyde, phthalic anhydride, cotton linters, etc., will continue to be needed in great quantities for high octane gasoline, ammunition and other purposes. It is thus improbable that molding or extruding compounds or laminating varnish will flood the market immediately. Furthermore, there are military developments underway which could conceivably require more plastic war materials and machines.

In addition, machinery manufacturers are likely to be handicapped by a shortage of component parts for many months to come. Besides, they must constantly devise new machines and tools to produce the improved fighting equipment developed by the Armed Forces.

Despite these apparent shortages of both machines and raw materials, no one believes that molders will suddenly cease asking for presses. Since there is little likelihood that presses and extruders will be available in anywhere near the desired quantity for months to come, various responsible officials were questioned in an effort to find out what they are going to do about allocating available injection machines in the future.

The first answer was that the eighteen machines allocated for the second quarter went to plants in which they could be used for military purposes. No one can blame molders if they question that reply, for the fact seems well established that many machines allocated in the past have been and are even now running on civilian items.

The reason stems back to Army and Navy procurement officers who in earlier days frequently insisted that certain jobs could best be done in specified plants. In some cases these jobs went to firms never before in the plastics industry simply because the manager or his representative convinced the Armed Forces officer that he was most qualified to do the job. Then the Services would request a machine for a war job and ask that it be allocated to the new bidder. Sometimes he finished his war contract within a few weeks or months and then applied for raw material to make civilian goods. Together with the ready availability of scrap and the high percentage of rejects of items that would be used by civilians as well as the military forces, this situation helps to explain why dime stores were filled with plastic items.

There were many variations to this system of obtaining a machine. A majority of the allocated machines went to plants where there were already a goodly number, and a large part of them were sent at the recommendation of Army and Navy officers. The machine was granted supposedly because it was needed for a war job. In other cases machines were granted because older presses were worn out and new ones were needed to fill the war job. When the military job was done, the molder went back to civilian items. On the other hand, an interesting tabulation could be made of military requests that were refused and of the numerous occasions when WPB spread the business among several molders.

But what of the future? It would seem that there could be a small increase in the last few months of 1945. Because it can be only small, the question of who gets what rises in importance. Too, military influence in allocations may decline and the choice between applicants becomes more complex with fewer claims of essentiality. When asked how distinctions can be made when machines become plentiful, but still not sufficient to meet demands, an official said that:

1. Machines for military purposes would come first.
2. Plants whose old machines have been most heavily engaged in war work would get first choice of new machines.
3. Replacement of obsolescent machines, especially when they have deteriorated in war service, would have next call.
4. Additional machines would be given to plants having a small percentage of war work next, at about the same level as
5. Those plants which have done a great deal of war work, but have been allocated new machines for doing it.
6. Newcomers in the industry who have never had machines before. This category may be difficult to deal with if Smaller War Plants gains in power during reconversion.

The above, of course, applies only if allocation controls are maintained by WPB. Many officials seem to believe that the machine manufacturers should be entitled to make a certain number of machines which would then be distributed similar to Paragraph (f) of Order M-300.

The immediate future for compression presses and extruders looks no better than for injection machines. It now takes from two to four months to obtain a compression press and six months to obtain an extruder. Compression presses are distributed by authority of WPB as fast as they can be manufactured, but producers are far behind schedule.

There are only seven or eight new extruders for the plastics industry each month. All others are going into the continually expanding rubber program. Many extruders were channelled into wire-coating because of a heavy military and naval cable program, which has passed its peak. However, no one is willing to state that this will result in more extruders for straight plastic work.

Only about twelve hot-plate presses have been granted to plywood manufacturers in the past three years. The demand for hot-plate presses is increasing steadily because of the expanded uses for resin-bonded plywood.

Foreign demands for all types of hydraulic presses will certainly make it difficult for manufacturers to satisfy the demand for a long time.

BECAUSE VELON* IS...

COLORFUL
Practical in a vast range of lively colors from palest pastels to deep jewel tones.

DECORATIVE
Infinite variety not only in color but also in patterns, weaves, textures, weights.

CLEANABLE
Restored to original freshness at a wipe with a damp cloth or cleaning fluid.

DURABLE
After years of wartime use in public conveyances, it shows no signs of stretching, sagging or wear.

STAINLESS
Grease, grime, dirt, alkalis, acids cannot penetrate or cling to the fabric.

NON-ABSORBENT
The individual threads are absolutely non-porous, homogeneous throughout.

NON-FADING
The color is inherent throughout each fiber—cannot be affected by light or oxidation.

MOST of *Velon* is at war today, but you'll want to consider its amazing and varied uses for your postwar products. We'll be glad to discuss practical applications of *Velon* or work out new forms according to your needs. Plan with *Velon* today, for tomorrow.

BEST TODAY—STILL BETTER TOMORROW

Listen to the Voice of Firestone Monday Evenings over NBC

Firestone

*Trademark pronounced VEL-LON

NEWS OF THE INDUSTRY

★ R. W. LYTLE, VICE-PRESIDENT in charge of special engineering of Formica Insulation Co., Cincinnati, Ohio, has been given national recognition for his wartime contribution to development of postwar aviation by the National Aircraft Standards Committee, according to an announcement received. Mr. Lytle, who will serve on the Committee on Postwar Airplane Pulley Design of the standards committee will be the representative of all pulley manufacturers in the country on this committee.

★ THE HENRIK BAEKELAND Medal of the North Jersey Section of the American Chemical Society, consisting of a gold medal and $1000, was recently awarded to Dr. Edwin R. Gilliland, former assistant Rubber Director. Dr. Gilliland is a professor of chemical engineering at Massachusetts Institute of Technology, now on duty with the Office of Scientific Research and Development.

★ PETER MÜLLER-MUNK HAS RE-signed from the faculty of Carnegie Institute of Technology and taken offices in the Clark Building, Pittsburgh 22, Pa., in order to give his full attention to filling orders from the War Department and to product design for leading manufacturers.

★ C. W. MARSELLUS HAS TERMI-nated his association with Universal Plastics Corp., New Brunswick, N. J., to become sales manager of Elmer E. Mills Corp.

★ ANNOUNCEMENT HAS BEEN made of the election of Howard Nicol, Research Laboratory, Goodyear Tire and Rubber Co., Akron, Ohio, as president of the Cleveland section of SPE, succeeding L. H. Williams of Ohio Rubber Co.

★ NEWLY ELECTED VICE-PRESI-dent of St. Regis Paper Co., New York City, is C. R. Mahaney who has been general manager of the Panelyte Division of the organization since 1935.

★ THE BUREAU OF HIGHPOLY-mer Research at the Polytechnic Institute of Brooklyn makes a contribution to polymer chemistry in offering its first laboratory clinic on "Weight and Shape of Polymer Molecules" for practicing chemists in a series of lecture and laboratory courses from 9:30 a.m. to 9:30 p.m. during the week of Monday, July 23, to Friday, July 27. The clinic will be under the direction of Dr. Herman F. Mark, internationally noted authority on highpolymer chemistry, who is professor of organic chemistry at the Polytechnic Institute and director of the Highpolymer Research Bureau.

★ THE INCANDESCENT LAMP manufacturing plant of Ken Rad Tube and Lamp Corp. at Owensboro, Ky., has been purchased by Westinghouse Manufacturing Co., Pittsburgh. The liquidation and dissolution of Ken Rad follows the completion of the deal. The corporation's assets used in the manufacture of radio tubes have been sold to General Electric Co., Schenectady, N. Y.

★ PHILIP H. RHODES HAS RE-cently been elected to the Board of Directors of Pennsylvania Coal Products Co., Petrolia, Pa., and made vice president in charge of the Penacolite Division. A 50 percent increase in resorcin production is planned by that company to become effective about the first of July.

★ DOW CHEMICAL CO. HAS moved its St. Louis offices to the Continental Building, 3615 Olive Street.

★ UNITED STATES RUBBER CO., New York City, announces the promotion of R. C. Harrington to the position of technical director in charge of development, engineering, quality control, purchasing and technical contacts with clients.

★ S. L. FLUGGE HAS BEEN AP-pointed director of container research for the Continental Can Co., New York City. Formerly manager of manufacturing research, Mr. Flugge assumes the post previously held by C. E. Maier, who is now assistant to Paul E. Pearson, vice-president in charge of equipment development and research.

★ MONSANTO CHEMICAL CO.'S plastics division at Springfield, Mass., announces the promotion of Carl F. Graesser to the position of assistant sales manager for thermosetting materials.

★ A FIFTH UNIT OF THE NEO-prene plant operated by E. I. du Pont de Nemours & Co., Inc., at Louisville, Ky., has been completed. The $7,000,000 addition will increase production of this high priority synthetic rubber by approximately 26 percent, making an annual volume of 60,000 tons.

★ BATTELLE MEMORIAL INSTI-tute of Columbus, Ohio, announces the appointment of a new staff member, J. Russell Bircher, Jr., who will do research work in organic chemistry.

★ W. J. SIMPSON HAS JOINED THE staff of Chrysler Engineering Corp. where his work will be in the rubber and plastic laboratories. Mr. Simpson received his degree in chemical engineering from the Univ. of Illinois and was with the Goodyear Tire and Rubber Co. from 1934 to November 1944.

★ PLASKON DIV., LIBBEY-OWENS-Ford Glass Co., Toledo, Ohio, announces the appointment of K. D. Meiser as production superintendent in charge of the Toledo, Ohio, and Grasselli, N. J., plants, and A. W. Kassay as assistant production superintendent for the Toledo plant.

★ BRISTOL CO., MANUFACTURERS of automatic control and recording instruments, Watertown, Conn., announces the recent appointment of C. E. Mason to the position of technical director.

★ I. G. STEWART HAS BEEN AP-pointed manager of the new San Francisco office of Pittsburgh Plate Glass Co.'s Columbia Chemical Division.

★ THE HOUSE OF PLASTICS, Cleveland, Ohio, has moved from 1720 Euclid Ave. to new and larger quarters at 735 Carnegie Ave.

★ BENJAMIN O'SHEA AND FRED H. Haggerson have been re-elected as chairman of the board of directors and president, respectively, of Union Carbide and Carbon Corp.

★ CHICAGO DIE MOLD MFG. CO. will henceforth be known as Chicago Die Mold Corp. with the following officers: president and treasurer, E. A. Petersen, and vice-president and secretary, Bertha Matthews; George Ugilt will be one of the directors of the corporation.

★ PAUL R. HOFMANN, FORMERLY director of research at Virginia-Lincoln Corp., Marion, Va., has joined the Shellmar Products Co., Mount Vernon, Ohio, where he will serve as manager of product research and development.

★ MYSTIK ADHESIVE PRODUCTS, a division of Chicago Show Printing Co., Chicago, Ill., has disclosed preliminary plans for entrance into the consumer market with a number of new products as soon as availability of materials permits. Among these will be Mystik, waterproof cloth tape coated with a plasticizer, which will come in rolls and packages for retail store distribution. The firm is now engaged principally in war production of pressure-sensitive adhesive products.

Sorry!

★ IN THE ARTICLE "A RE-designed compass" which appeared on page 110 in the May issue, Lucite should have been mentioned as the type of methyl methacrylate used in this application.

Chemcot is an important part of all these products—and many others. If you manufacture a cellulose product, you will want to know more about *Chemcot*.

DERIVATIVES OF CELLULOSE

- *Inorganic Esters:* such as nitrocellulose for quality smokeless powders and "celluloids" for films, foils, sheets, and shapes.
- *Organic Esters:* such as cellulose acetate, and mixed esters such as cellulose acetate-butyrate for yarns, sheets, rods, tubes, and films.
- *Regenerated Cellulose* for viscose high tenacity rayons, cuprammonia rayons, thin films and tubes for sausage casings, and transparent foils.
- *Alkali Cellulose* for ethers such as ethyl-, benzyl-, hydroxyethyl-, carboxymethyl-, cellulose which have applications as textile finishes, coating agents, and potential applications as synthetic lacquers.

FOR THE 4TH TIME— ARMY-NAVY "E" AWARD

To Find the Best—Make Your Own Test

Many laboratory tests made by our customers prove that *Chemcot* is the purest form of commercial cellulose on the market. Its high alpha-cellulose content (99%-plus) produces stronger, clearer, more salable products.

An actual test eliminates "guess." Why not let us send you enough *Chemcot*--(either bulk or sheeted)--to make your own tests? There is no cost.

The entire *Chemcot* organization is eager to work closely with those who now manufacture cellulose products, or others who plan to produce them.

Write, wire or phone your needs today, giving tentative specifications or end uses.

CHEMCOT
PURE COTTON CELLULOSE

WRITE, WIRE OR PHONE YOUR NEEDS TODAY

SOUTHERN CHEMICAL COTTON COMPANY

CHATTANOOGA 10, TENNESSEE

Molded casket hardware

IN THE manufacture of casket hardware, plastics are sharing in a job that metals used to do entirely by themselves. Correctly applied, the plastic materials are standing on their own merits, and their use has proved so satisfactory that many leading casket manufacturers have enthusiastically adopted them as standard material.

Casket hardware includes handles, corners and other functional pieces of a casket, in fact, all parts other than the shell which is made of wood, steel and aluminum.

Experiments in the use of plastics for casket hardware began about two years before Pearl Harbor. As soon as war started to channel off certain critical metals, the use of plastics in these applications began to save thousands of pounds of needed steel, lead and zinc. Currently, more than 15 designs of plastic handles and other functional pieces are available.

Although the use of plastics does not reduce initial production costs, other advantages provide compensation. A set of plastic lugs, or handles, for example, weighs 3.2 lb. as compared with 16 lb. for the same-sized set of steel lugs. Since weight is an important factor in shipping, both in cost and convenience—particularly in wartime—the advantages effected in shipping from the hardware manufacturer to the casket maker, and from the latter to the undertaker, are obvious. A further advantage is the ease of speed and assembly by ordinary shop methods. Just as metals are cast in large quantity for economy, so the plastic materials are molded in quantity. Some 2000 pieces can be turned out in a 24-hr. day in one shop, depending on the size of the part which is being molded.

The material used for most casket hardware items is cellulose acetate and cellulose acetate butyrate, when available. The use of standard formulae insures that the material will remain constant. Some regrind plastic is mixed with the original compound yet this has no effect on the finished quality of the product.

Parts are injection molded on an 8-oz. machine. The compounds are first softened by automatic preheating, then dried, again automatically, in an infrared oven. From this point the material is fed into the hopper and carried along to the mold by a vibrator while a fan blows off fumes and moisture given off by the compound.

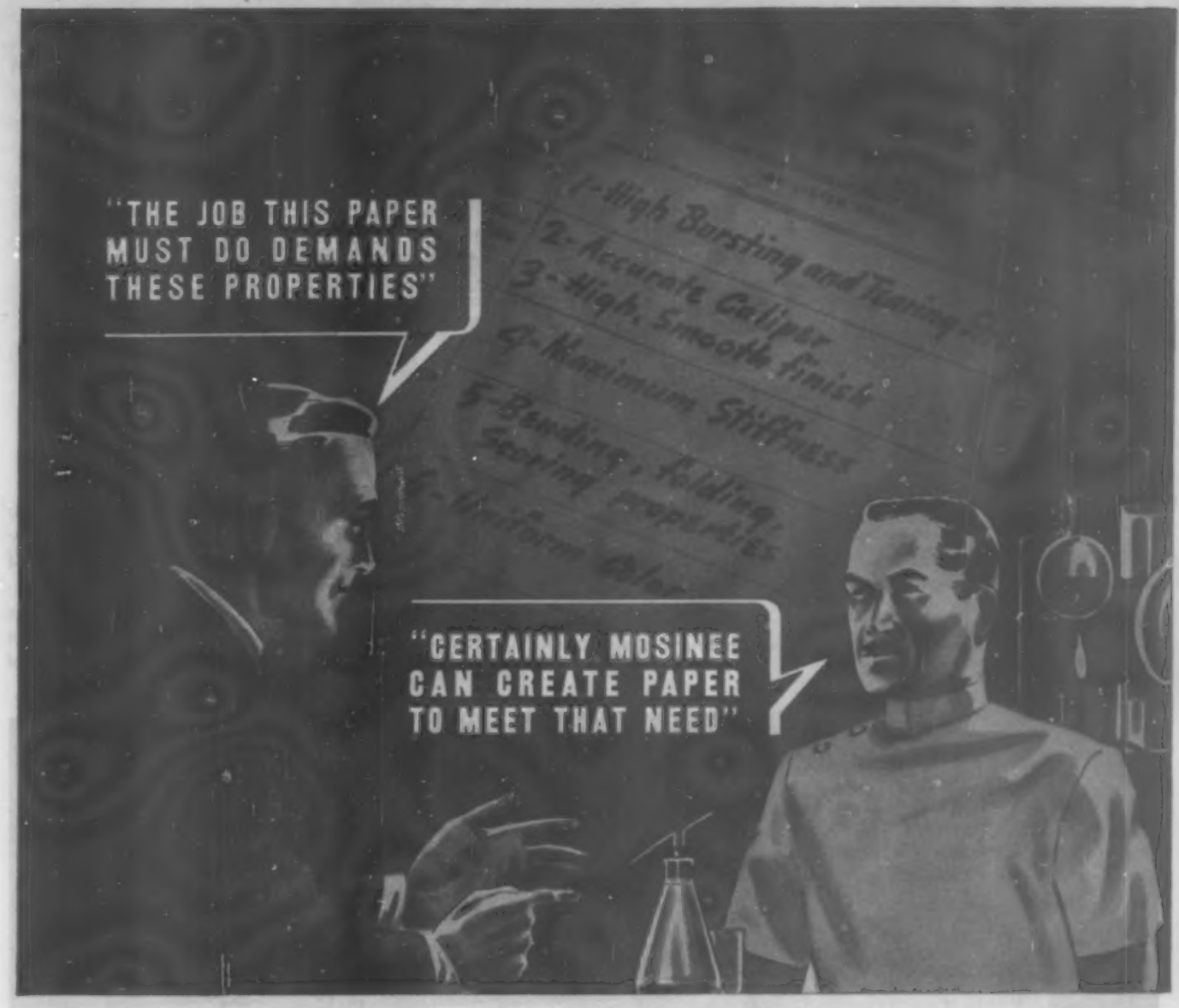
Plastic casket hardware has stood up under various tensile tests. Under one such test, 525 lb. of weight were required to pull the screws from the plastic handles. Tests have also been passed successfully for resistance to rust and corrosion and peeling. Of course, in ease of finishing and appearance, the plastic parts rank high.

An unlimited color range provides the casket designer with a wide variety of selections. Under current wartime conditions, however, colors have been more or less standardized to conserve labor. Available colors include light bronze, copper tone with light bronze shade, wine, gold and orchid. In colored plastics, the parts are lacquered for luster.

Customer satisfaction is evident. The president of a long-established casket manufacturing firm—one of the most important companies active in this industry—is not only enthusiastic about the use of plastics in casket hardware but also predicts that other applications of plastics in this industry are "just around the corner. Metal has its place, and plastics have their place," he explains. "However, we have found the use of plastics in casket hardware manufacturing so satisfactory that at present we are designing a casket to be made entirely of plastics."

Credits—Materials: Lumarith and Tenite II. Molded and merchandised by Wm. Thoresen Co.

Casket hardware molded of cellulose acetate and cellulose acetate butyrate has several advantages over their metal counterparts. These include light weight, ease of finishing and variety of color


"THE JOB THIS PAPER MUST DO DEMANDS THESE PROPERTIES"
1-High Bursting and Tearing
2-Accurate Caliper
3-High, Smooth finish
4-Maximum Stiffness
5-Bending, folding, Scoring properties
6-Uniform
"CERTAINLY MOSINEE CAN CREATE PAPER TO MEET THAT NEED"

- - and MOSINEE made it!

Your paper problem is not apt to be identical to that of even your most direct competitor . . . Although you both may be aiming at the same end-result, there probably is a difference in procedure or equipment . . . and for such differences you may need a specially engineered paper . . . it might speed production, or improve your product, or both!

Mosinee paper technicians are alert to such situations. When given opportunity to know what paper properties you require, and what your production set-up demands, the Mills of Mosinee adjust *their* processes to meet *your* paper requirements.

With information like the above, we can go to work immediately. What properties or characteristics are needed for your paper?

Please address your letter "Attention Dept. A"

MOSINEE PAPER MILLS COMPANY

MOSINEE • WISCONSIN

Essential Paper Makers

Impact strength

(*Continued from page 152*) for the difference in the notch effect on these two materials except possibly the relatively low shear strength of the paper laminate parallel to the laminations contrasting with the greater shear strength of the cord-filled material in the same direction (along a plane through the apex of the notch) caused by the projection of some of the cords into the section adjacent to the notch.

Bending and toughness coefficient

The tensile and flexure properties of most of the materials are given in Table VI. No relationship was established between the impact strength and the tensile strength of the materials indicated in the tests.

Data have been reported on the energy absorbed in the Izod impact test compared with the energy required to rupture a specimen in the static flexure test.[3] The flexure formula used therein, a different form of which is given by Timoshenko,[4] was applied to the results of bend tests of some of the materials used in the impact tests listed in this report. The energy formula for a simple beam loaded at the center, as given by Timoshenko[4], is:

$$E = \frac{S^2 A l}{18 M} \qquad \text{(Equation 1)}$$

where

E = strain energy absorbed, in.-lb.
S = flexural stress, p.s.i. (below proportional limit)
A = beam cross-sectional area, sq. in.
l = beam length, in.
M = flexural modulus of elasticity, p.s.i.

This formula was developed by Timoshenko[4] into:

$$e = \frac{Su^2}{18M} \qquad \text{(Equation 2)}$$

where

$e = F/lA$ = toughness coefficient
Su = modulus of rupture in bending

This formula was derived for stresses within the elastic limit, but has been used for determining approximate energy to rupture because of the nearly straight line characteristic of the flexure curve of many plastic materials, especially the reinforced thermosetting types. The toughness coefficient has been calculated and plotted in Figs. 9 and 10 for comparison with both Izod and Charpy tests, since the different types of

[3] Symposium on Impact Testing, A.S.T.M. Proceedings, 1938, Pt. II.
[4] Timoshenko, "Strength of Materials," Pt. I.

8—Types of fractures of Izod and Charpy impact specimens. (Identifying data on each specimen shown in this illustration can be found listed in the table which appears under Fig. 7 on page 152)

Could you Machine this Work in 5 Simple Steps?

Photo courtesy
Parker Stamp Works, Inc.,
Hartford, Connecticut

A Milwaukee 2D Rotary Head Milling Machine milled this Walkie-Talkie part mold in 5 simple steps in a total time of 90 hours — a typical speed, economy, and accuracy performance. Here is the sequence of operations:

1—Strap both mold halves together in an upright position on machine table and mill "Ear" and "Mouth" sections complete.

2—Mill elongated sections for core guide.

3—Position mold blocks on machine table as illustrated, lay out and mill handle grip section complete

4—Mill core guide and recesses to form small pass at the "Mouth" end of molded part.

5—Mount core holding plate in vise and mill 3 recesses.

Total machining time — 90 hours.

Check these advantages of the Milwaukee 2D Rotary Head Milling Machine and how you can benefit from them in your own shop:

DIRECT . . . mills mold cavities in a single setup without the aid of templets or models, transmitting blueprint dimensions and outlines directly to the workpiece.

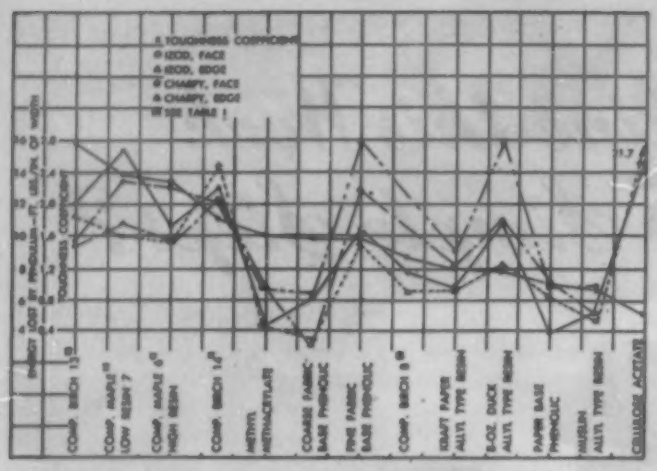
ACCURATE . . . chances for error are eliminated because there is no change in setup. Exact control of all combinations of cutting movements — possible only with this machine — transmits mathematical precision to the work.

FAST . . . initial job preparation and setup time is reduced to the minimum. Accurate performance of the machine saves operator's time and rapid production of intricate molds and dies is the result.

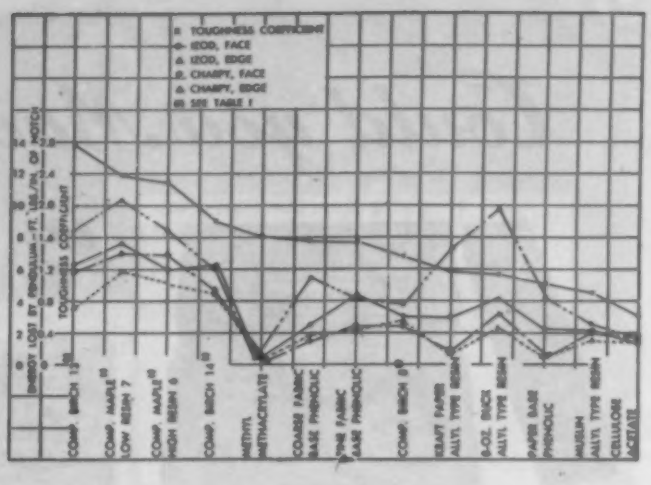
Write for Bulletin No. 1002C and complete information.

BUILDERS OF MILWAUKEE ROTARY HEAD MILLING MACHINE • MIDGETMILL • SPEEDMILL • FACE MILL GRINDER • AUTOMETRIC JIG BORER • CENTER SCOPE.

Kearney & Trecker
Products
CORPORATION
Milwaukee 14, Wisconsin
Subsidiary of Kearney & Trecker Corporation



9—*The unnotched impact strength is shown in its relation to the toughness coefficient. All of the specimens were tested longitudinally at room temperature*



10—*This chart shows the relation of the notched impact strength to the toughness coefficient. All of the tests were made on longitudinal specimens at room temperature*

beam loading would change only the constant in Equation 2 and would not affect the relative shapes of the curves in Figs. 9 and 10. No definite correlation is apparent for unnotched impact curves with the toughness coefficient curve, but the curves for the notched specimens, with a few exceptions, in a general way decrease as the toughness coefficient decreases.

The error introduced by the straight line assumption in the derivation of the toughness coefficient is not deemed excessive in view of the nearly straight line characteristics of the bend curves for all the materials tested except the cellulose acetate and methyl methacrylate plastics. No analysis for the purpose of explaining the variations between the toughness coefficient and impact values was attempted, but the curves are included to indicate the influence of various types of materials on the impact properties as related to the static bend properties. All bend results were obtained on unnotched rectangular specimens with a span-depth ratio of approximately 16.

Types of impact fractures

Figures 7 and 8 show representative fractures at room temperature of the two types of compressed impregnated wood, three types of laminated phenolics and two thermoplastics. These seven types of materials were selected as representative of all the types of fracture obtained. The section of the fracture initially in compression is at the top and that in tension is at the bottom. Considerable difference, which can be most plainly seen in numbers 12, 17 and 23 in the figures, was noted between the two sides of the fracture of some of the specimens, the compression side being relatively smooth when compared to the more jagged and irregular tension side. There were no pronounced differences between the Izod and Charpy impact fractures, except that there appeared to be more shear parallel to the length of the Charpy specimens than for the Izod specimens because of the higher proportion of failure in a plane nearly parallel with the sides of the specimens. No Charpy impact fracture is shown for cellulose acetate in the unnotched condition because the capacity of the machine was not great enough to obtain a break. The Izod specimens prepared from cellulose acetate were tested in a 120 ft.-lb. Izod impact machine used for metal testing and no comparable Charpy machine of suitable capacity and equipped for a specimen with a 4-inch span was available.

TABLE VI.—TENSILE AND FLEXURE PROPERTIES OF PLASTICS USED IN THE IMPACT TESTS

Material[a]	*Ultimate tensile strength*	*Modulus of rupture in bending*
	p.s.i.	*p.s.i.*
Methyl methacrylate	7,650	11,350
Cellulose acetate	3,900	4,900
Cellulose acetate, soft	6,400	....
Cellulose acetate, hard	7,400	....
Cellulose acetate butyrate, soft	4,900	....
Cellulose acetate butyrate, hard	6,500	....
Vinyl chloride acetate	9,400	15,500
Polystyrene	3,700	....
Cast phenolic	10,000	15,600
Aniline-formaldehyde, 1	7,880	10,800
Aniline-formaldehyde, 2	9,370	11,540
Allyl derivative resin	4,000	7,900
Bagasse	3,100	6,240
Cotton-fiber, phenolic	28,000	32,000
Wood-pulp, phenolic	9,000	....
Paper phenolic laminate (XX)	16,100	18,400
Fine-fabric phenolic laminate (L)	17,000	21,400
Coarse-fabric phenolic laminate (C)	14,700	21,400
Glass-cotton cloth phenolic laminate	38,000	34,800
High-strength-paper phenolic laminate[b]	25,000	26,000
Muslin allyl laminate	7,700	10,400
Duck allyl laminate	7,900	12,700
Kraft-paper allyl laminate	13,620	17,050
Hurlbut-paper allyl laminate	9,900	14,000
Glass-cloth allyl laminate	27,650	23,900
Lignin laminate	11,670	17,400
Lignin phenolic-faced laminate	7,310	13,200
Cotton cloth urea laminate	6,900	9,600
Compressed maple, low resin, 6	30,600	41,900
Compressed maple, high resin, 7	32,900	41,850
Compressed birch, phenolic, 8	31,000	31,500
Compressed birch, polyvinyl formal, 13	35,160	33,000
Compressed birch, phenolic, 14	37,290	47,200

[a] All materials were tested lengthwise. The values are averages for 3 specimens. Numbers after materials refer to various types of same class materials; see Table I.
[b] Equal properties in lengthwise and crosswise directions.

NOW

JOB TESTED

resin for bonding

PHENOLIC LAMINATES

IMPREGNATED WOOD

PHENOLIC MOLDED PIECES

RESINOX 410

Wing tabs manufactured with Resinox 410 by Hood Rubber Co., Watertown, Mass.

New to many, but tried and proved on many a vital war job, is Monsanto's thermosetting phenolic bonding resin, Resinox 410 . . . now ready for additional assignments.

Its use in making wing tabs and fillets for fighting aircraft, for making oil filters for the B-29, and other critical parts proves the practical value of Resinox 410.

The ease of use with various materials under wide-ranging conditions has shown the material to have:

1. Excellent versatility . . . time, temperatures and pressures are not critical. Skilled labor not required. Resinox 410 bonds cured phenolic laminates, impregnated wood and phenolic moldings equally well.
2. Bond meets high strength requirements, is non-brittle and shows excellent resistance to vibrational stresses.
3. Short curing time . . . 10 to 15 minutes after glue line has reached curing temperatures of 275-350° F.
4. Long assembly life...after application of Resinox 410 final curing may be delayed as much as three months.
5. No high pressures needed . . . simple contact effected through clamps, weights or ordinary presses is sufficient.
6. For certain jobs Resinox 410 can be extended with walnut shell or wood flour and can be diluted with water or mixture of water and alcohol.

HOW RESINOX 410 IS USED FOR GENERAL ADHESIVE APPLICATIONS

1. Both meeting surfaces should be cleaned thoroughly, particularly if any mold lubricants have been used. Although not necessary, a roughened surface is preferred.
2. Brush adhesive onto both meeting surfaces, at a solids content of 40%.
3. Coated surfaces should be allowed to dry for approximately one hour at room temperatures. (At temperatures between 200°-250° F. time can be reduced to about 10-15 minutes.)
4. After drying surfaces may be placed in immediate contact and glued, or they may stand in open or closed assembly for a period of up to 3 months at room temperature.
5. Curing is accomplished by placing the dried, coated surfaces together and applying sufficient pressure to maintain intimate contact. Assembly is then heated to about 300°-350° F. Resinox 410 cures in 10-15 minutes after glue line has reached this temperature.

MONSANTO PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

For complete information on Resinox 410, or others in Monsanto's series of industrial resins for bonding, laminating, coating or impregnating address: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

Shoe test results

(*Continued from page 101*) conditioned at 70° F. and 65 percent relative humidity and on specimens which had been immersed in water at 70° F. for 4 hr. prior to test.

Change in thickness on immersion in water—The thickness of four specimens, 2 by 1 in., was measured after conditioning for 48 hr. at 70° F. and 65 percent relative humidity and after immersion in water at 70° F. for 4 hours. None of the materials delaminated or separated in this test.

Loss in weight on heating—Two specimens, 1 in. by 5 in. by the thickness of the sheet, were conditioned for 48 hr. at 77° F. and 50 percent relative humidity and then weighed. The specimens were heated in a circulating-air oven on a metal plate at 180° F. for 72 hr., being turned over after 48 hours. After the heating treatment, the specimens were reconditioned at 77° F. and 50 percent relative humidity for 48 hr. and then weighed. The loss in weight was calculated on the basis of the original conditioned weight. The oven-aged specimens were subjected to the bend test described in the text which follows.

Flex fatigue life[1]—The machine for this test consists of a stationary head which holds one end of the specimen and a reciprocating head which holds the other end. The motion of the reciprocating head bends the specimen transversely. The frequency of the machine was 115 cycles per minute. Flexible tabs were stapled to each end of the 2.5 by 5-in. specimen and the tabs clamped in the grips of the machine. At the closed end of the flexing cycle, the test piece was bent to a $^1/_8$-in. inside diameter. The tests were made at 32° F.[2] One specimen cut in each of the two principal directions of the sheet was used for this test. There were no significant differences in the results of the tests in the two directions.

Bend test—The resistance of the materials to cracking was determined by bending specimens, cut 1 by 5 in. in each of the two principal directions of the sheet, over a $^1/_2$-in. mandrel through an angle of 180°. Attempts were made to make 10 bends in 10 sec., but some of the materials became too stiff at the lower temperatures to make the 10 bends in this time. The tests were made at 0, −20 and −40° F., and the specimens were conditioned for at least 16 hr. at the indicated temperature prior to test. Tests were made on unaged and oven-aged specimens.

Abrasion resistance by NBS leather machine—Abrasion resistance by this method was determined in accordance with the American Leather Chemists Association procedure for "Measuring Abrasive Resistance of Heavy Leather." The apparatus for this test consists essentially of a vertical wheel, 15 in. in diameter, around the circumference of which are mounted 12 test specimens. The specimens make contact with a sheet of abrasive paper or cloth which is mounted on a horizontal disk. The vertical wheel is driven at 30 r.p.m., and the distance from the axis of the horizontal disk to the center line of the specimen is 5.5 inches. When the vertical wheel is raised by means of a spring balance attached at the free end of the shaft supporting the wheel, the indicated force is not more than 36 lb.; when the wheel is lowered the indicated force is not less than 33 pounds. The point of attachment for the balance is 27 in. from the axis of the driving wheel and 9 in. from the axis of the vertical wheel on which the specimens are mounted.

Motion of the horizontal disk is retarded by a Prony brake. This consists of a leather belt, 1.25 in. wide, fastened to the frame at one end, which passes around a drum 12 in. in diameter and supports a load of 20 lb. at the free end. The tension on the end of the belt that is fastened to the frame while the machine is running is not more than 0.1 pound.

The abrasive was No. 50 silicon carbide, spread evenly on a cloth disk 14 in. in diameter. The abrasive was of such size that all passed a No. 30 U. S. Standard sieve while at least 60 percent was retained on a No. 50 U. S. Standard sieve. The cloth backing was drill, 30 in. wide, 2.85 yd. per pound, and properly backfilled prior to coating. The quantity of abrasive was not less than 31.1 lb. nor more than 37.7

[1] These tests were made by Mr. F. W. Duggan in the laboratory of the Bakelite Corporation in Bound Brook, New Jersey. His assistance is gratefully acknowledged.

[2] This equipment is described more fully in Industrial and Engineering Chemistry, *35*, 172–176 (Feb. 1943).

TABLE II.—DESCRIPTION OF VINYL PLASTIC SHOE SOLE MATERIALS

Sample designation	*Type of resin*	*Fibrous filler*	*Appearance*
1	Vinyl chloride acetate scrap	None	Black, embossed on one side, carpet on back
2	Vinyl butyral scrap	None	Black, embossed on one side, carpet on back
3	Vinyl chloride acetate scrap	Fiber from scrap	Brown, embossed on one side
4	Vinyl chloride acetate scrap	None	Black, embossed on one side
5	Vinyl chloride acetate scrap	Glass fiber	Black, embossed on one side
6	Vinyl chloride acetate scrap	None	Black, paper on one side
7	Vinyl chloride acetate scrap	None	Black
8	Vinyl scrap	Cotton flock	Black, fabric on one side
9	Vinyl chloride scrap	None	Black, embossed on one side
10	Vinyl scrap and GR-S	None	Black
11	Vinyl chloride acetate scrap	Asbestos filler	Black, fabric on one side
12	Vinyl scrap	None	Black
13	Vinyl scrap	None	Black
14	Vinyl chloride acetate scrap	None	Black
15	Vinyl chloride acetate scrap	None	Black
16	Vinyl chloride acetate scrap	None	Black, embossed on one side
17	Vinyl chloride acetate scrap	Cotton flock	Brown
18	Vinyl chloride acetate scrap	None	Black
19	Vinyl chloride acetate scrap	None	Chocolate
20	Vinyl chloride acetate scrap	None	Chocolate
21	Vinyl chloride acetate virgin	None	Transparent, colorless
22	Vinyl chloride acetate virgin	None	Brown
23	Shoe sole leather (vegetable tanned bend)		

When CATS hobnob with Canaries

Unusual combinations, like the duet above, bring KYS-ITE to mind. It offers such unexpected combinations as great strength and lightness, ruggedness and beauty . . . plus the other "seldom-found-together" properties mentioned below. All of which give you additional advantages when planning products for now or postwar.

GREAT STRENGTH WITH LIGHT WEIGHT

Preformed before curing, an even distribution of phenolic resin on interlocking fibres results in great tensile and compressive strength and with an impact strength up to 5 times that of ordinary plastics.

WIDE RANGE OF SHAPES

Complicated pieces with projections and depressions, large or small shapes and sections—all these and more, too, are molded successfully in KYS-ITE.

KYS-ITE CAN "TAKE IT"

Unusually durable and resistant to abrasion, impervious to mild alkali and acid solutions.

INTEGRAL COLOR

KYS-ITE's lustrous finish is highly durable; the color is an integral part of the material itself. A wipe and it's bright!

NON-CONDUCTOR

KYS-ITE's dielectric properties make it invaluable where safety is a factor. Also a non-conductor of heat. Non-resonant and non-reverberating.

WE MOLD TO SPECIFICATIONS

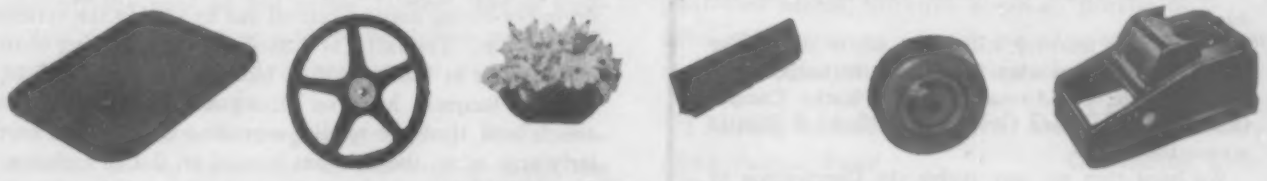
Call on us for complete cooperation. Production scheduled as orders arrive. If your product can't be molded in KYS-ITE, we'll tell you about likely companies to contact. Your inquiries are invited.

Buy War Bonds—and Keep Them

KEYES FIBRE COMPANY
420 Lexington Avenue
New York 17, New York
Plant at Waterville, Maine

KEYES MOLDED PRODUCTS

KYS-ITE articles indicating the range of items we mold to specifications and deliver complete, ready for use.



KYS-ITE

The Long-Fibred Wood Pulp Filled Phenolic **Resin Plastic Pre-formed Before Curing**

Reg. U. S. Pat. Off.

lb. per sandpaper ream (9 by 11, 480). The abrasive was randomly deposited. A new sheet of abrasive was used at the beginning of each test, and at the beginning of each 4000 revolutions during the test.

Two specimens, 5.0 by 9.8 cm., were cut in each of the two principal directions of the sheet with a steel die. The thickness of each specimen was measured by means of a dead-weight type of gage equipped with a dial graduated to 0.001 inch. The presser foot of the gage was circular, with a diameter of 0.375 inch. The total load on the presser foot was 500 gm. All thickness measurements were made at five places—at the center, and near the four corners of the specimen about 0.5 in. from the edge. Metal backing strips for the specimens were provided. The specimens were cemented to the backing strips, the backing strips and specimens being bent in a press to the curvature of the wheel during this cementing. The specimens were then permitted to stand 48 hr. between the time they were cemented and the beginning of the test to insure complete evaporation of any solvent. If necessary, shims were used under the backing.

The test specimens (specimens cemented to backing strips) were conditioned for 48 hr. and tested in an atmosphere of 65 ±2 percent relative humidity at 70 ±2° F. The conditioned test specimens were weighed to the nearest 0.01 gm.

Abrasion resistance by Taber machine—The Taber machine used for this test was equipped with CS-17 wheels and extra weights to bring the weight of each individual head to 1000 grams. In other respects the tests were made in accordance with Method No. 1091 of Federal Specification L-P-406a.

The results of the tests are given in Table I. The vinyl plastic materials were inferior to the leather control in tensile strength and stitch tear, but were superior to the leather in change in thickness on immersion and abrasion resistance.

The correlation between the two abrasion tests is fair. The principal objection to the Taber machine in the evaluation of materials for shoe soles is that a very small amount of the surface of the material is worn away; for leather, only the grain portion is tested.

The unembossed materials which did not crack in the bend test at −20° F. were satisfactory for 300,000 or more cycles in the flex fatigue test. All of the embossed materials failed at 60,000 cycles or less in the flex fatigue test.

Just one month before Pearl Harbor, the winners in the Sixth Annual Modern Plastics Competition were announced. Six months later the plastics industry was running in high gear on its war job. Consequently, the Annual Modern Plastics Competition became a war casualty. In May 1942, instead of issuing our annual invitation to the plastics world to participate in this presentation, we felt compelled to announce the suspension of the Competition for the duration.

The plastics industry still has a job to do for the Armed Services, but when it has been discharged from active service, the Annual Modern Plastics Competition will once more turn the spotlight on plastics accomplishments.

We hope that we may revive the Competition in 1946, provided that easing of restrictions on material, machinery and manpower may permit civilian manufacture during the next six months. If conditions so warrant, we shall again be proud to announce the Seventh edition at the earliest possible date.

Conclusions

On the basis of these data, it is concluded that the following requirements should be met by vinyl plastics to be used for shoe soles:

Property	*Requirement*
Tensile strength	Minimum 1500 lb./in.²
Stitch tear, dry and wet	Minimum 30 lb./thickness of material
Flex fatigue life at 32° F.	Minimum 1,000,000 cycles
Bend test at 0° F., aged and unaged	Minimum 10 bends
Abrasion resistance, leather machine	Minimum 6000 rev./mm.
Abrasion resistance, Taber machine	Maximum 75 mg./1000 rev.

Sample 22 (Table I) made from virgin material and sample 15 meet the above requirements. Sample 21 made from virgin material and sample 17 failed in stitch tear by a small margin. Samples 1, 12, 19 and 20 also meet most of the above requirements. No data for flex fatigue life of these samples are available because of insufficient material. Sample 1 fails to meet the tensile strength requirement by a narrow margin. No tensile and Taber abrasion data are available for samples 19 and 20. Samples 4 and 9 meet all except the flex fatigue requirement, a failure that may be caused by the embossing since smooth materials are more satisfactory.

The materials meeting the above requirements did not contain fibrous fillers. This is particularly worth noting in view of the many cracking failures which have been experienced with soles made of large amounts of fibrous materials bonded with small percentages of resin.

If the sole is to be attached to the shoe by stitching only, the stitch tear requirement of 30 lb. may not be adequate. Higher stitch tear strength can be obtained by the use of a fabric backing material.

Dip coating

(*Continued from page 102*) have risen out of the solution, whereupon the temperature is reduced to 115 to 125° F.

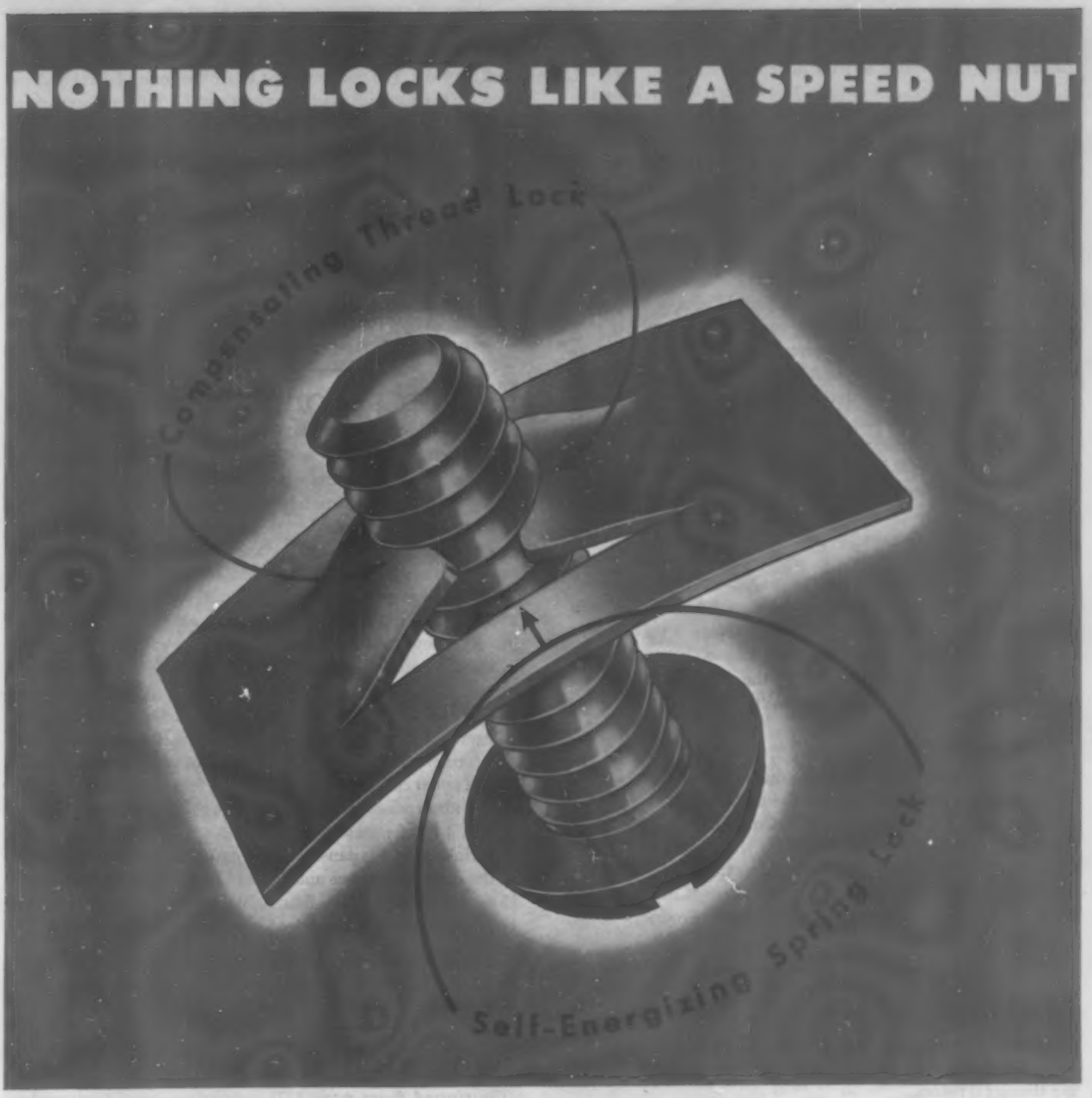
For production dipping operations, mechanical equipment should be used. Articles should first be dipped slowly in the hot solution and then withdrawn in a continuous motion. The coated parts should remain in the vapors of the solution above the surface for an instant after removal. Surface tension and shrinkage tend to draw into the lacquer any globule at the bottom of the dipped piece. However, the article should be promptly inverted after withdrawal from the solution in order to insure an over-all smooth surface.

While preliminary drying and thorough gelling of the lacquer coat are allowed to proceed at room temperature, final drying or curing may be carried out by setting the articles on a conveyor. The latter is passed through a drying chamber in which air at 130 to 140° F. blows countercurrently to it.

These lacquers have no strong adhesion to the coated article and therefore require a prime coat. This is particularly true when the solution is used on flat or concave surfaces.. Such a prime coat also serves to seal the piece being coated, eliminating the formation of bubbles in the coating caused by air which escapes from porous substances when immersed in a warm solution.

Credits—Material: Tenite II gel lacquers. Screw drivers coated by Vaco Products Co.

NOTHING LOCKS LIKE A SPEED NUT



SPEED NUTS are the only fastening devices that provide a COMPENSATING thread lock and a SELF-ENERGIZING spring lock. TWO distinct forces are exerted on the screw, as the SPEED NUT is tightened.

First, a compensating thread lock, the two arched prongs moving inward to engage and lock against the root of the screw thread. These free-acting prongs compensate for tolerance variations, and function perfectly on oversize or undersize screw or bolt threads.

Second, a self-energizing spring lock, created by the compression of the arch in both the prongs and base. The combined forces of the thread lock and spring lock definitely eliminate vibration loosening.

SPEED NUTS, proven in pre-war commercial industry and now boosting the production of airplanes, are ready to assist you in the assembly of post-war metal, vitreous enamel, plastic or wood products. Literature is available on over 3000 shapes and sizes, for standard or special assemblies.

TINNERMAN PRODUCTS INC.
2048 Fulton Road Cleveland, Ohio

Speed Nuts
PATENTED
* Trade Mark Reg. U. S. Pat. Off.

Shoes—today and tomorrow

(*Continued from page 99*) training at Camp Lee, Va., for field testing. The results of these tests which were conducted over two years ago indicated that polyvinyl butyral was a long-wearing material for use on heels but that it had a tendency to spread. On several pairs the vinyl soles cracked across the ball. However, those vinyl soles which were compounded with butadiene-acrylonitrile copolymer were found to be without this tendency.

When buna-S became available, tests were conducted at the Quartermaster Board in a manner similar to that outlined above on reclaim rubber and various percentages of neoprene, buna-S and crude rubber. The 30 percent crude rubber sole was used as the standard. Neoprene in percentages comparable to crude rubber gave equal wear. However, slightly greater percents of buna-S were required than of neoprene and crude rubber. Buna-S was adopted for use in soles and heels of Army service shoes and combat boots because it was readily available and it is easier to compound than is neoprene.

The toe of ski-mountain boots must be firm and must be strong enough to maintain its shape even under the pressure placed upon it by the ski binding. For the stiffening in the toe of this boot the most satisfactory material used by the Army has been a double layer of impregnated fabric.

Other uses of plastics in footwear have been adhesives in the many operations required to manufacture a shoe and in the tips on shoelaces. Work has been done on substitute materials made of plastic for the cuff of the combat boot and on impregnating cotton shoelaces to give them added wear.

Acknowledgments

We wish to thank the following companies and associations for their assistance in assembling the material for this article: Bakelite Corp., Bortman Plastics Co., Firestone Tire and Rubber Co., Freydberg Bros.-Strauss, Inc., B. F. Goodrich Chemical Co., Goodyear Tire and Rubber Co., Hodgman Rubber Co., International Shoe Co., Monsanto Chemical Co., National Shoe Manufacturers Assoc., Plastic Products Corp., and the U. S. Stoneware Co.

Melamine

(*Continued from page 140*) possible in applications of this type, the pump company molds the stators of plastic, retaining the metal rotors.

Because of the pressing need for a pump of this type for the production of melamine, there was no time for exhaustive tests to determine just which plastics would prove best in this particular application. The first unit to be used in our laboratories was constructed with a hardened steel rotor and a stator molded of a plastic which had previously proved successful on pumps designed for chemical fluids. While the pump performed successfully in the manufacturer's factory, it had been in service at our plant only a short time when it stuck fast.

Since the solvents were being pumped at approximately room temperature, it did not seem possible that expansion of the metal rotor had caused the difficulty. The next possibility was that the plastic stator had swelled due to solvent action, a suspicion which was soon confirmed. It was at this point that melamine was suggested as the material from which to mold the stator. Subsequent laboratory tests indicated that the solvents had no effect on a melamine stator—either on the smooth hard finish or on machined surfaces.

The new stator was machined by the pump company from a block of material molded of melamine reinforced with macerated cotton. The part was cut to fit the pump barrel and to produce the internal double screw thread. Put into service in August 1943, the pump with its melamine stator has been running with complete satisfaction ever since. During this time it has completed more than 5400 pump cycles of 20 minutes each against 300 p.s.i. of pressure and at least an equal number of similar cycles for the purpose of mixing solvents—in this case against lesser pressure. The performance of this first pump proved so satisfactory that three more similar units have been installed and already have some months' service.

Credits—Material: Melmac. Blocks molded by Synthane Corp. Stator machined by Robbins & Myers Inc., for their Moyno pump

Fifteen seconds to jump

(*Continued from page 126*)

In a final operation, the directions for use are stamped on the case by a roll-leaf machine especially adapted for the job at the rate of approximately 1000 per hour.

After the first four operations have been performed, cap protectors are tumbled. Black steel ferrules are next slipped over their open ends and crimped to anchor them in place. These ends are counterbored, then threaded by a machine with a revolving tapping head operated by compressed air. Finally they go to the stamping room to have the words "Cap Protector" printed on their sides and to rejoin their cases. Both pieces are rigidly inspected.

Corps of Engineers' specifications call for a housing that will remain serviceable when exposed continuously to a temperature of 160° F., and not become unsatisfactory or unduly brittle under continuous exposure to a temperature of —40° F. Water absorption must be low enough to withstand immersion in 3 ft. of water for 6 hours.

Shrinkage and expansion of the cast phenolics are negligible, so the castings for case and cap can be machined to extremely close tolerances. Non-flammable and non-absorptive, the housings have been in service for approximately a year.

Credits—Material: Catalin. Fabricated by Plastic Turning Co. for E. I. du Pont de Nemours & Co., Inc., for use by the U. S. Army Corps of Engineers.

Sandwich structure

(*Continued from page 137*) guarantees consistent production results. For example, in the present experimental program, no fuselage sections had to be discarded. The first two produced were assembled and met all static tests.

4. *Simple and structurally sound repair*—Damage by gunfire of the all-laminate construction was less than for either wood or metal. Also, the simple technique of repairs, involving no equipment not easily available in the field, offers a great advantage over metal for many parts.

5. *Availability of materials*—Both constituents of the construction—resin and glass cloth—can be readily expanded in production from most available raw materials, to meet conceivable demands.

References

[1] "Development of Glass-Reinforced Low Pressure Plastics for Aircraft," Col. Paul H. Kemmer, MODERN PLASTICS, *21*, 89 (May 1944).

[2] "Application of Glass Laminates to Aircraft," Capt. George B. Rheinfrank, Jr., and Lt. Wayne A. Norman, MODERN PLASTICS, *21*, 94 (May 1944).

Credits—Material: Resin, Plaskon 911; Fabric, Fiberglas ECC-112.

YOU'RE UP NEXT

Whether You're Ready or Not

All over the nation, factories have been busy making war materials. Production and more production has been the objective. The demand for products was automatic, because the need was urgent. Sales ideas were not as important as they are today.

Now that the European war is over, the wise industrialist realizes that he must think in terms of streamlined products to meet the long-deferred demand for new and better things. He must also think in terms of initiative and selling effort. Hence, the importance of selecting the right kind of product.

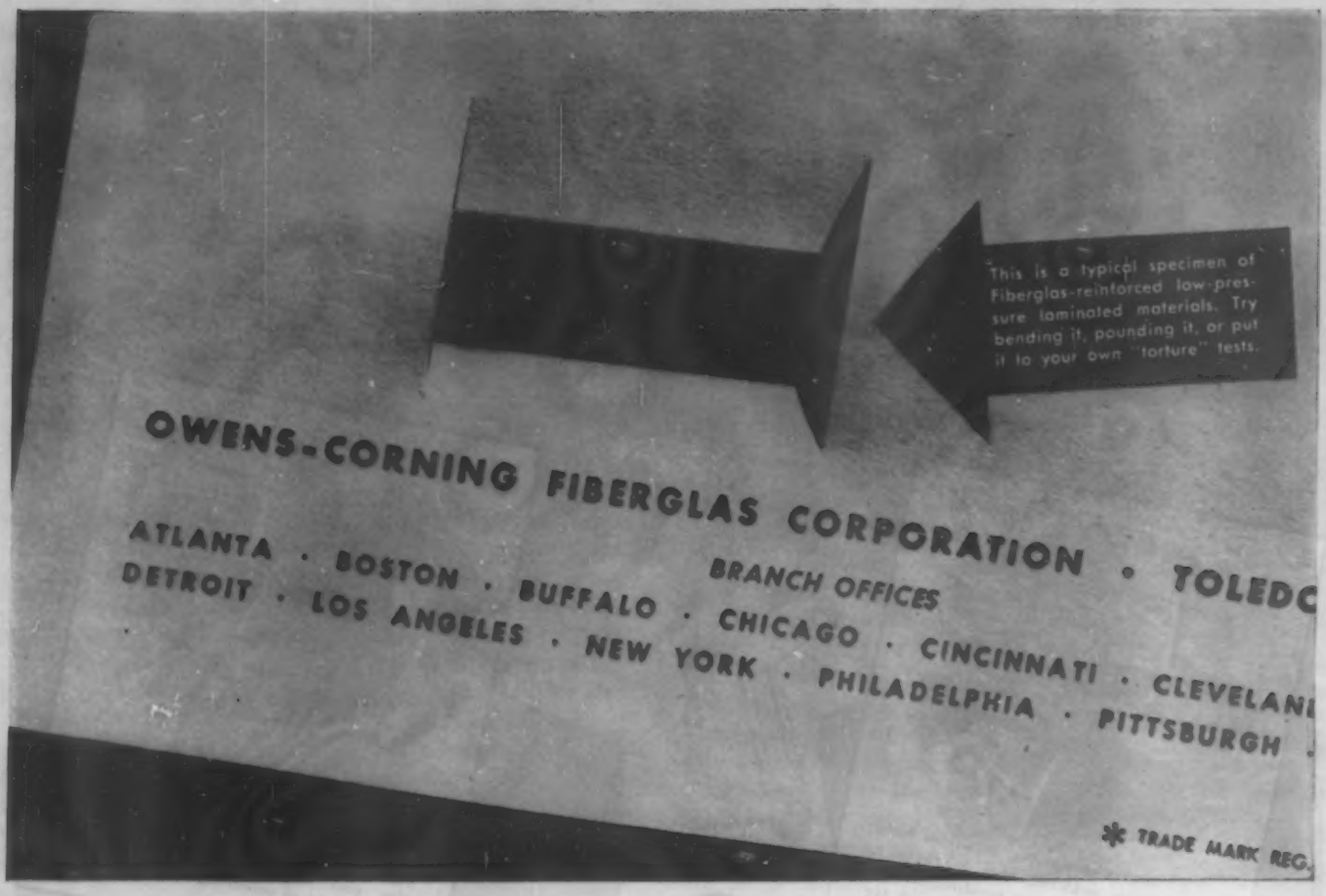
Cutbacks are now in existence, and the end of the Japanese war will mean *complete reconversion* to peacetime needs. Immediate plans must be made if the manufacturer is to gain equal opportunity when competition is keenest.

Valin, the modern plastic, can help you to be prepared for the new era of opportunity by making sales easier because of its streamlined beauty and usefulness. *You are safe if you act in time.* Write for full information about Valin and its adaptability to a variety of peacetime needs.

BUY WAR BONDS
AND KEEP THEM

Valin

VALIN DIVISION • VIRGINIA-LINCOLN CORPORATION • MARION, VIRGINIA


This is a typical specimen of Fiberglas-reinforced low-pressure laminated materials. Try bending it, pounding it, or put it to your own "torture" tests.
OWENS-CORNING FIBERGLAS CORPORATION • TOLEDO
BRANCH OFFICES
ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND
DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH
* TRADE MARK REG.

WANT TO TEST IT YOURSELF?

FIBERGLAS*-REINFORCED plastics have passed the "aircraft test" with flying colors. This new material is being used in the fabrication of flat sheets, structural members and formed parts in many types of aircraft where great strength with light weight, dimensional stability, and resistance to moisture and temperature changes are of vital importance. It combines properties and characteristics which are not found in other materials.

Test it yourself. Write for the sample laminate included with the new folder "Low-Pressure Laminates Reinforced with Fiberglas Cloth". Try bending it, pounding it, or put it to your own torture test. Then determine where the advantages of this improved material can be applied to the products you are planning on making.

Fiberglas is glass in the form of fine fibers or filaments having extremely high tensile strength. Twisted into yarns, woven into cloths and tapes, these Fiberglas textiles impart their properties to the finished low-pressure plastics laminates.

For example, impact strength from five to ten times that previously obtained in laminates is now being attained through Fiberglas reinforcement. The glass fibers have great flexibility and stand high stresses without permanent deformation. They are not affected by moisture and temperature changes within the range of commercial usage; they remain dimensionally stable.

Write for your copy of the new folder, with sample attached, today. Owens-Corning Fiberglas Corporation, does not manufacture resins or finished laminates but will be glad to furnish experimental samples of Fiberglas textile materials and data on technique in their use with plastics. Write *Owens-Corning Fiberglas Corporation, 1876 Nicholas Bldg., Toledo 1, O.*

In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

ARMY E NAVY

FIBERGLAS.. A BASIC MATERIAL

*T. M. Reg. U. S. Pat. Off.

LINCOLN

2-Stage HYDRAULIC SYSTEMS

with Selective Intensifier

Will Save Time, Cut Operating Costs, Provide Positive Pressure Control —on Your Presses, too...

Above—A typical control cabinet on a Lincoln Hydraulic System. A single control lever takes care of all operations.

At Right—A Lincoln Booster Pump for Hydraulic Systems. Selected high pressure is automatically sustained without horsepower consumption—no by-passing or pressure relief valves.

CUSTOM MOLDERS

CMC

CONSUMER MOLDING

COMPRESSION MOLDING COMPANY OF ST. LOUIS

7329 SOUTH VANDEVENTER AVE. (10), SAINT LOUIS

NE. 0680

PLASTIC WALL TILE

Lincoln Engineering Company
5730 Natural Bridge
St. Louis, Missouri

March 9, 1945

Attention: Mr. Dorsey

Gentlemen:

Attached is our purchase order for another Lincoln Hydraulic System of the same type that we customarily purchase.

We now have seven of your systems in operation at our plant. We have just installed two 16" ram presses in line with the large HPM press and all the presses have molds mounted in them and are running.

In addition to these presses we have purchased six additional presses all of which will require Lincoln systems within the near futur*. We have found that the new 15 H. P. compressor is far in excess for the six presses we have operating and we know definitely that we will be able to add the six new presses well within the limit of our compressor's capacity. That will mean that we are operating twelve plastic molding presses on this one 15 hp motor that would normally require a minimum of 107 hp with the conventional direct drive hydraulic equipment. This is a most interesting fact.

Please let us know how soon we can expect delivery of this additional Lincoln system.

Very truly yours,
COMPRESSION MOLDING COMPANY
Charles D. Pauli, Jr.
Charles D. Pauli, Jr.

This typical letter tells how Lincoln Hydraulic Systems give users outstanding economies. Note particularly the savings in motor horsepower.

LINCOLN ENGINEERS CAN HELP YOU IN SELECTING THE PROPER HYDRAULIC EQUIPMENT...

Recommendations of the proper Lincoln System will be made by our Engineers upon receipt of the following information... Ram Diameter—Maximum Stroke—Platen Size—Total Weight of Platen, Ram and Dies—Distance and Speed of Daylight Closing—Maximum Compression Stroke—P. S. I. Ram Pressure—Time of Cycle desired—and any other related facts affecting operation.

Please send complete bulletins ☐, *or recommendations on the basis of the attached specifications* ☐.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

MP 8031

LINCOLN ENGINEERING COMPANY

Pioneer Builders of Engineered Hydraulic Equipment

THE CARVER LABORATORY PRESS

STANDARD FOR RESEARCH AND DEVELOPMENT

Milestones in Plastics

Michigan had been newly admitted into the Union. Van Buren was President. And a man named Regnault had just prepared the first vinyl resin. The year was 1838. For nearly a century little attention was given to the material. In sharp contrast to this long period of relative anonymity is the rapid development of vinyl types in recent years—indicative of the continuous experimental work going on in the plastics industry.

The distinctive properties of vinyl compounds have been put to many useful purposes in war production and hold bright promise for service to industry in peacetime.

A number of important discoveries in plastics were made more than 100 years ago. Contrasted with the slow progress of the early plastics pioneers, development during the past 15 years has been phenomenal. In large measure, this stepped-up tempo is due to intensive laboratory research and constant endeavor to improve methods and materials. Aiding in this research and development is the Carver Laboratory Press, now considered to be essential equipment in thousands of laboratories. This press has a reputation built on accuracy and dependable performance. It is standard

- for making quick and accurate small-scale pressing tests.
- for development, research and instruction work.
- for testing single cavity molds.
- for preparation of samples.
- and even for small-scale production.

Original in design, the Carver Laboratory Press is small, compact,

- has a pressing capacity of 20,000 lbs.
- weighs only 125 lbs.
- operates under self-contained hydraulic unit, giving any precise variations in pressure that may be desired.
- large accurate gauge of finest construction is rigidly mounted on base.
- special gauges are available for low pressure work.

Carver Press accessories include electric and steam hot plates and test cylinders or molds. Standard interchangeable accessories are available for general research—cage equipment, bearing plates, filtering equipment, etc. Send now for latest catalog.

PROMPT DELIVERIES FROM STOCK.

FRED S. CARVER
HYDRAULIC EQUIPMENT
343 HUDSON ST., NEW YORK 14

CASE HISTORIES ON

Cardolite Cashew Resins

Trade Mark

INDUSTRY . . . Chemical Equipment

PROBLEM . . . Alkali Resistance

Manufacturer of chemical equipment was unable to find a binder and tank lining which would not saponify in service, until CARDOLITE Liquid Polymer 816 was adopted. The equipment is now in daily use, satisfactorily handling alkaline solutions.

INDUSTRY . . . Synthetic Rubber

PROBLEM . . . Hardness without embrittlement

Required hardness could be obtained by this manufacturer only by heavy loading . . . with consequent embrittlement. CARDOLITE Polymer 5615 now gives the required hardness plus toughness . . . the embrittlement overcome.

These are but two of the many problems efficiently and economically solved by CARDOLITE Resins . . . resins derived from the high molecular weight, unsaturated, phenolic-type material extracted from the Cashew Nut shell. One of the numerous other CARDOLITE Resins may well provide the solution to some problem now engaging your attention.

Why not check that possibility? Write to Dept. 146 for information and samples consistent with your requirements.

IRVINGTON

VARNISH & INSULATOR COMPANY

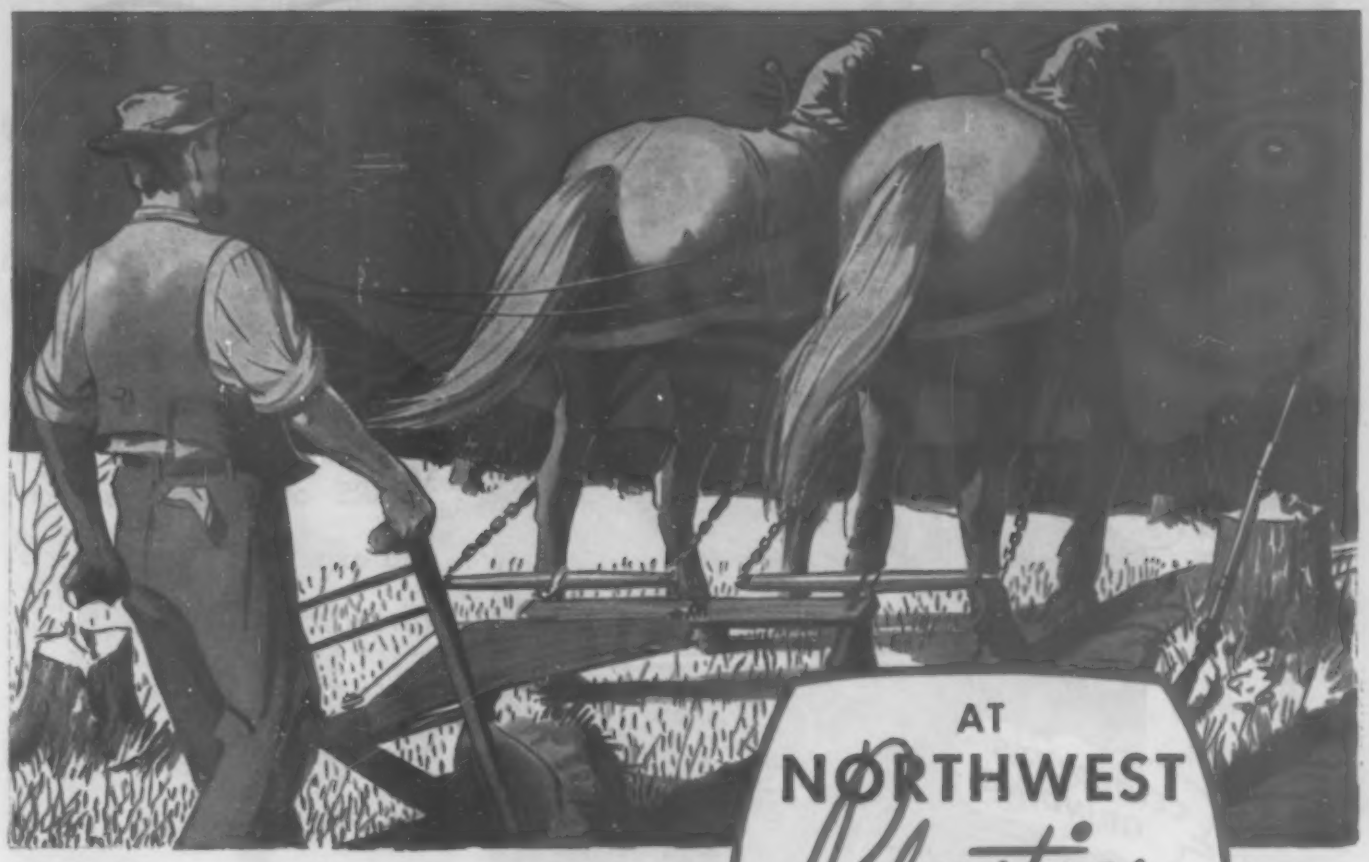
Irvington 11, New Jersey

Tooling

Tooling of intricate moulds for any complex moulding problem is another of the complete list of services we offer you, moulds that consistently turn out dependable plastic parts or products in any plastic process. For postwar plastics think of Bridgeport.

BRIDGEPORT MOULDED PRODUCTS, INCORPORATED

BRIDGEPORT B CONNECTICUT



WE'RE BREAKING NEW FIELDS!

Recent war-born materials and methods of fabrication are of interest to our customers, old and new. Here at Northwest Plastics we are continually engaged in development work with new materials and techniques. The manufacture of large articles by contact or "impression molding" methods, the casting of tools, jigs and fixtures from phenolic and thermoplastic resins, and the extrusion of thin films are currently engaging our attention.

Our special transfer molds of three to twelve cavities which are used with special transfer presses are designed to provide a method for maintaining molding pressure on the piece while the mold is removed from the press, and curing is completed in an oven. This technique, in rubber molding for example, permits a press to handle twenty molds per hour as against two molds per hour with conventional methods.

If your problems involve the services of an outstanding molder with vision, won't you please write or wire us. Northwest Plastics, Inc. 2233 University Ave., St. Paul 4, Minnesota.

ARMY ORDNANCE AWARD

FOR MERITORIOUS PRODUCTION

Compression molding • Transfer molding • Injection molding • Extrusion molding
Modern Tool and Die Department • Finishing, Fabricating and Assembling Department
Laboratory for Development and Production Control • Engineering and Product Design

NORTHWEST PLASTICS Inc.

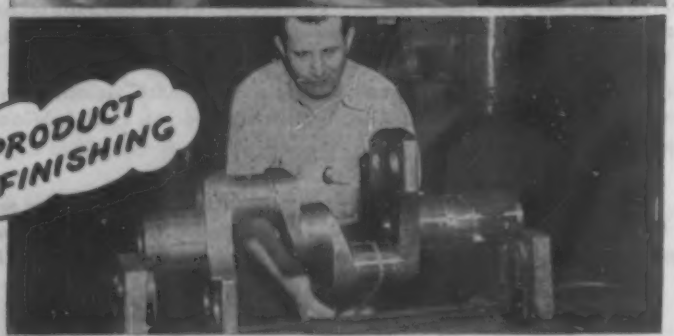
THERE IS A PRODUCT BY "CARBORUNDUM" FOR EVERY ABRASIVE APPLICATION!

TOOL-ROOM GRINDING

CENTERLESS GRINDING

CENTER-TYPE GRINDING

PRODUCT FINISHING



YEARS of skilled research and experience by "CARBORUNDUM" Abrasive Engineers have led to the finest, most complete line of abrasive products on the market — abrasives that give you the maximum in efficient production at the lowest possible cost. Consult our nearest office to obtain the right abrasive product by "CARBORUNDUM" to meet your particular requirements.

The Carborundum Company,
Niagara Falls, New York.

THERE IS A PRODUCT BY

CARBORUNDUM

TRADE MARK

FOR EVERY ABRASIVE APPLICATION

("CARBORUNDUM" is a registered trade mark of and indicates manufacture by The Carborundum Company)

For Your SALVAGE OPERATIONS

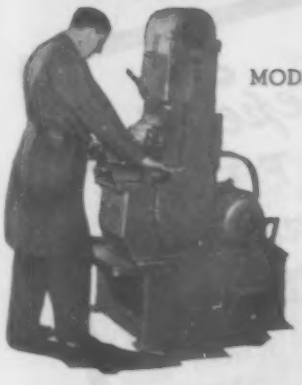
Often the whole profit and loss picture depends upon your Salvage operations. The department handling that part of the job must have equipment that will salvage most of your rejects. The PORTER-CABLE Wet-Dry Belt Surfacer is versatile and adaptable to many requirements of the Salvage operation. In one machine you get a Wet Belt for Thermo-plastics; a Dry Belt for Thermo-Setting Plastics! It is adapted to flash, fin, and gate removal; finishing rough spots; and scores of other machining operations!

MODEL 8-6W

MODEL WG-4 ★

Used in Production, This Better Machining Will Lower Your Salvage Quota

- Eliminates Flow—Discoloration—Warping—Dust!
- Smooths Molded Defects!
- Holds Contour!
- Gives all-over finish to spheres and cylinders!
- Requires less operator training!
- 5 to 25 times faster than many common methods!



MODEL WG-8

PORTER-CABLE MODERN SURFACERS

There's a PORTER-CABLE machine that will bring the savings and efficiencies of Wet-or-Dry Belt Surfacing to any operation you may encounter. Models are now available with Hydraulically controlled, Micrometer-Stop Adjustment Automatic Feed Tables—piling huge operational savings on top of those already effected by this new Surfacing technique.

★

The Porter-Cable Wet-or-Dry Belt Surfacer is as revolutionary in concept as the Plastics industry itself! Ask for your FREE copy of this important book.

PORTER-CABLE MACHINE CO.
1606-7 N. Salina St.
Syracuse 8, N. Y.

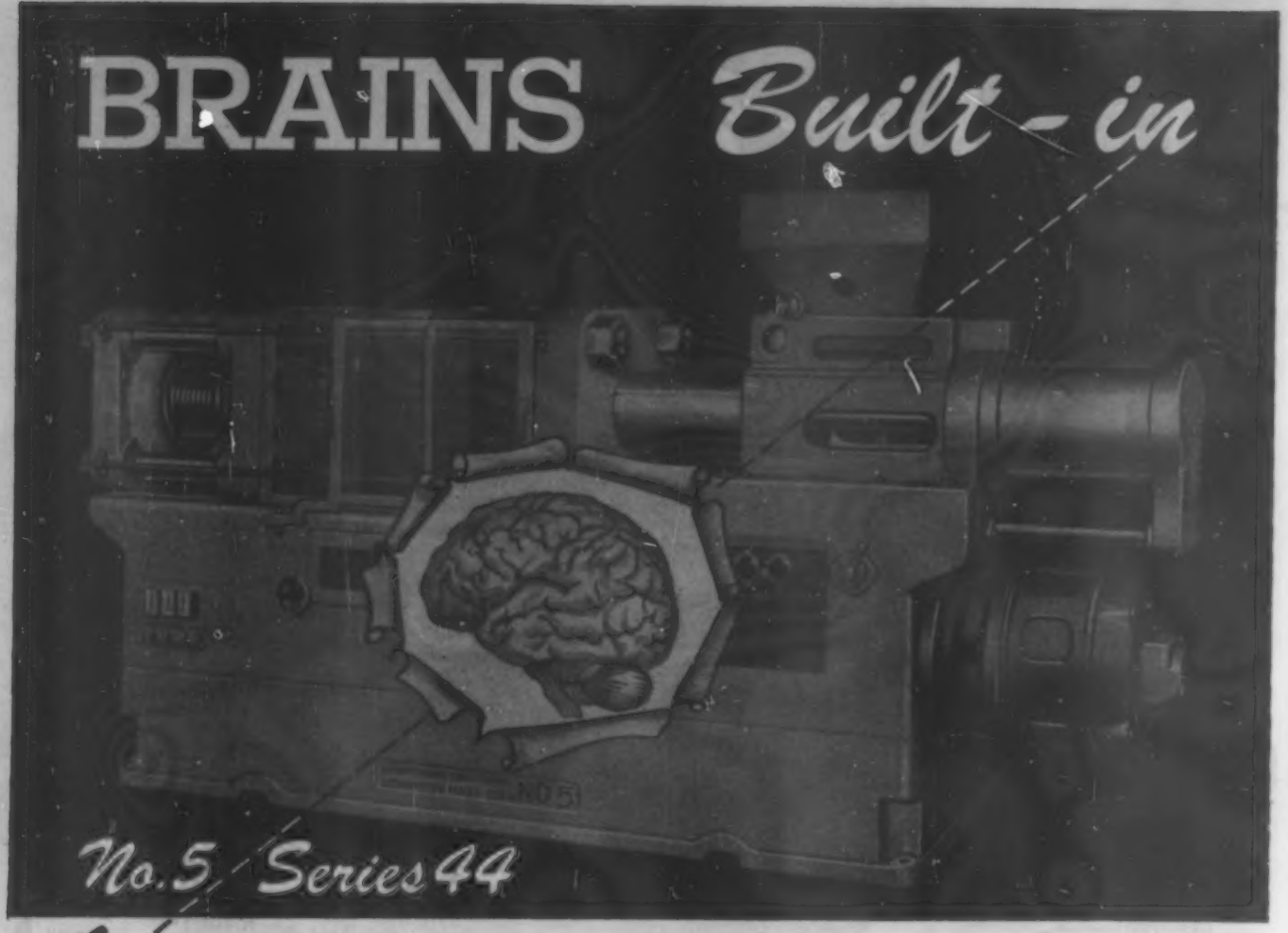
I'd like to learn more about this modern machining method. If you'll send me a book, I'll read it!

Name ..... Title .....

Company ..... Street .....

City ..... State .....

BRAINS *Built-in*



Leominster
INJECTION MOLDING MACHINE

New precision die-alignment, achieved by one adjustment of a single screw, eliminates multiple die adjustment and resultant inaccuracies. This improved adjustment control prevents flooding, reduces rejects to minimum.

"Central-shaft" centralized movable plate support equalizes pressure distribution, and full length pin support in the heavy-duty toggle assembly gets rid of toggle trouble.

Uniform thrust action of the multiple knock-out pin system prevents cramping, breakage and wear of ejection parts.

For Precision Production, Speedy and Safe — Depend on Leominster

2 *Independent* SAFETY *Factors*
Protect The Operator

Machine cannot function while *either* door is open, or when either of the two independent safety controls becomes inactive. Thus utter protection of operator, and "automatic insurance" are effected. Front and back guard doors open individually.

LEOMINSTER TOOL CO., Inc.

LEOMINSTER, MASSACHUSETTS

MANUFACTURERS OF MACHINES AND MOLDS FOR THE PLASTICS INDUSTRY

	FEATURES	Airtronics	Preheater "A"	Preheater "B"	Preheater "C"
1	**DUAL LOAD SELECTION** — two independent sets of timer and power controls.	✔			
2	**AUTOMATIC POWER REGULATION** — constant power is maintained during heating interval.	✔	✔		
3	**AUTOMATIC LOAD CIRCUIT TUNING** — preheater efficiency is maintained at maximum regardless of changes in material characteristics.	✔			
4	**INPUT VOLTAGE REGULATION** — compensates for variations in line voltage over 200-240 volt range.	✔	✔		✔
5	**DESIGNED FOR *CONTINUOUS* OPERATION** — tubes, transformers and all other components operate at conservative ratings for *continuous* service, insuring minmum operational failures.	✔			
6	**STEPLESS POWER CONTROL** — permits easy, accurate pre-setting of power output at desired level.	✔	✔		
7	**CONTROLS CONVENIENTLY PLACED** — timer and power controls accessible to operator if minor adjustments are needed.	✔	✔		
8	**SELF-ALIGNING OUTPUT ELECTRODES** — insure equal distribution of electro static field and heating.	✔			✔
9	**ADJUSTABLE AIR GAP** — provides either contact or air gap between upper electrode and preforms.	✔			
10	**WIDE RANGE OF APPLICATION** — special electrodes available for preforms of unusual shape.	✔		✔	
11	**PREFORMS IN FULL VIEW** — preforms are visible at all times to the operator.	✔	✔	✔	
12	**UPPER ELECTRODE INTERGRATED WITH HOOD SHIELD** — when shield is raised, upper electrode rises and retracts; when shield is lowered, upper electrode descends to operating position.	✔	✔		

Compare AIRTRONICS Model DE with the field

Make this 12-point comparison test yourself — consider the facts ... then buy AIRTRONICS

THE *Only* PREHEATER THAT HAS *all* THESE ADVANTAGES

AIRTRONICS

MODEL DE

All of these advantages add up to *Faster, Better, Simpler* preheating. Consult the AIRTRONICS Sales engineer nearest your plant for the engineering details and how you can use AIRTRONICS to speed your production schedule, or send for the *new* folder that completely describes this high-production preheater. Write Dept. MP.

Airtronics MFG. CO.

CHICAGO, 407 S. Dearborn Zone 5 — NEW YORK, 31-28 Queens Blvd. Long Island City, Zone 1 — LOS ANGELES, 5245 W. San Fernando Rd. Zone 26

THE CARVER LABORATORY PRESS

STANDARD FOR RESEARCH AND DEVELOPMENT

A number of important discoveries in plastics were made more than 100 years ago. Contrasted with the slow progress of the early plastics pioneers, development during the past 15 years has been phenomenal. In large measure, this stepped-up tempo is due to intensive laboratory research and constant endeavor to improve methods and materials. Aiding in this research and development is the Carver Laboratory Press, now considered to be essential equipment in thousands of laboratories. This press has a reputation built on accuracy and dependable performance. It is standard

- **for making quick and accurate small-scale pressing tests.**
- **for development, research and instruction work.**
- **for testing single cavity molds.**
- **for preparation of samples.**
- **and even for small-scale production.**

Original in design, the Carver Laboratory Press is small, compact,

- **has a pressing capacity of 20,000 lbs.**
- **weighs only 125 lbs.**
- **operates under self-contained hydraulic unit, giving any precise variations in pressure that may be desired.**
- **large accurate gauge of finest construction is rigidly mounted on base.**
- **special gauges are available for low pressure work.**

Milestones in Plastics

Michigan had been newly admitted into the Union. Van Buren was President. And a man named Regnault had just prepared the first vinyl resin. The year was 1838. For nearly a century little attention was given to the material. In sharp contrast to this long period of relative anonymity is the rapid development of vinyl types in recent years—indicative of the continuous experimental work going on in the plastics industry.

The distinctive properties of vinyl compounds have been put to many useful purposes in war production and hold bright promise for service to industry in peacetime.

Carver Press accessories include electric and steam hot plates and test cylinders or molds. Standard interchangeable accessories are available for general research—cage equipment, bearing plates, filtering equipment, etc. Send now for latest catalog.

PROMPT DELIVERIES FROM STOCK.

FRED S. CARVER
HYDRAULIC EQUIPMENT
343 HUDSON ST., NEW YORK 14

CASE HISTORIES ON

Cardolite Cashew Resins

Trade Mark

INDUSTRY . . . Chemical Equipment

PROBLEM . . . Alkali Resistance

Manufacturer of chemical equipment was unable to find a binder and tank lining which would not saponify in service, until CARDOLITE Liquid Polymer 816 was adopted. The equipment is now in daily use, satisfactorily handling alkaline solutions.

INDUSTRY . . . Synthetic Rubber

PROBLEM . . . Hardness without embrittlement

Required hardness could be obtained by this manufacturer only by heavy loading . . . with consequent embrittlement. CARDOLITE Polymer 5615 now gives the required hardness plus toughness . . . the embrittlement overcome.

These are but two of the many problems efficiently and economically solved by CARDOLITE Resins . . . resins derived from the high molecular weight, unsaturated, phenolic-type material extracted from the Cashew Nut shell. One of the numerous other CARDOLITE Resins may well provide the solution to some problem now engaging your attention. Why not check that possibility? Write to Dept. 145 for information and samples consistent with your requirements.

IRVINGTON

VARNISH & INSULATOR COMPANY

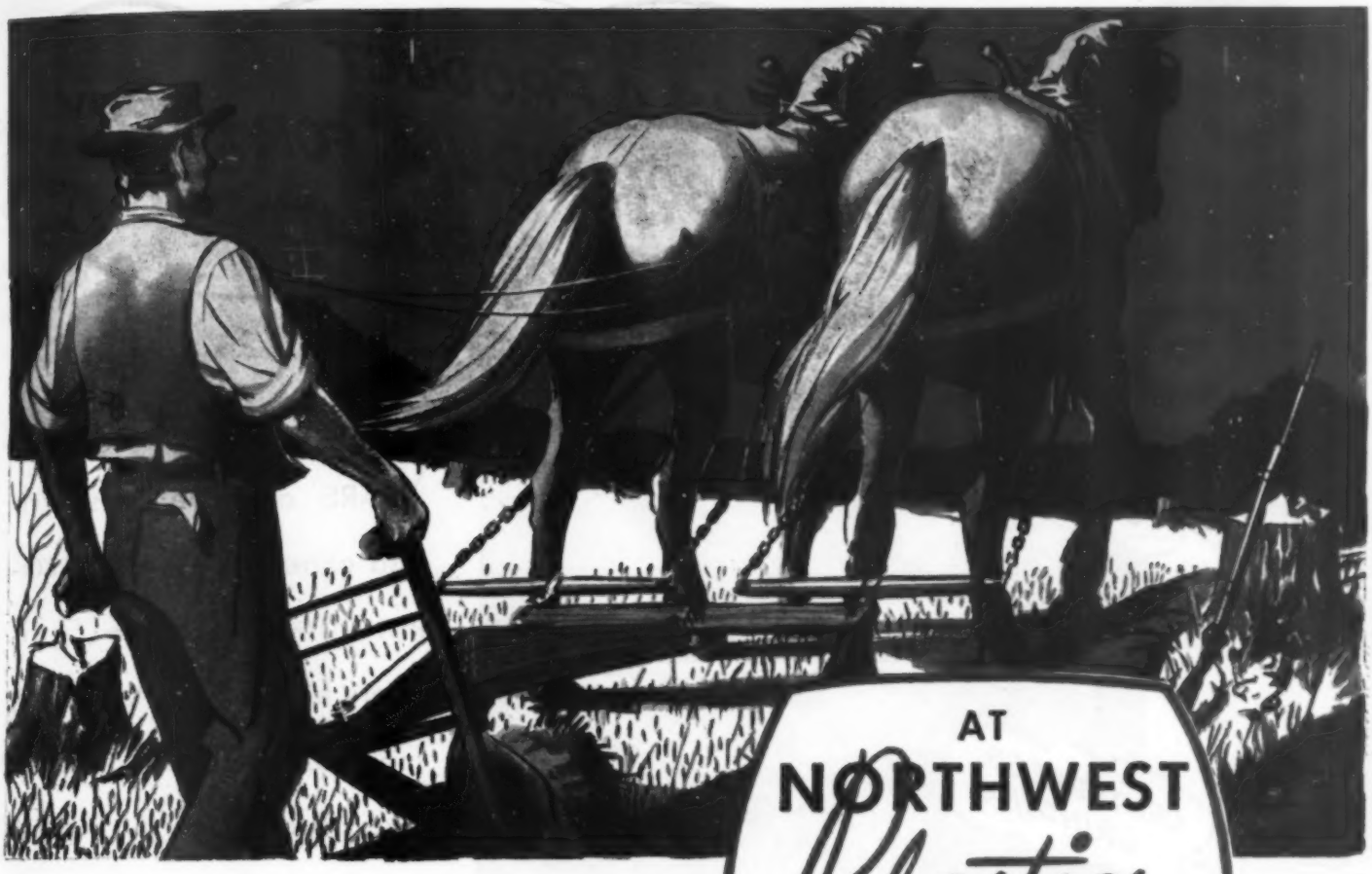
Irvington 11, New Jersey

Tooling

Tooling of intricate moulds for any complex moulding problem is another of the complete list of services we offer you, moulds that consistently turn out dependable plastic parts or products in any plastic process. For postwar plastics think of Bridgeport.

BRIDGEPORT MOULDED PRODUCTS, INCORPORATED

BRIDGEPORT B CONNECTICUT



WE'RE BREAKING NEW FIELDS!

Recent war-born materials and methods of fabrication are of interest to our customers, old and new. Here at Northwest Plastics we are continually engaged in development work with new materials and techniques. The manufacture of large articles by contact or "impression molding" methods, the casting of tools, jigs and fixtures from phenolic and thermoplastic resins, and the extrusion of thin films are currently engaging our attention.

Our special transfer molds of three to twelve cavities which are used with special transfer presses are designed to provide a method for maintaining molding pressure on the piece while the mold is removed from the press, and curing is completed in an oven. This technique, in rubber molding for example, permits a press to handle twenty molds per hour as against two molds per hour with conventional methods.

If your problems involve the services of an outstanding molder with vision, won't you please write or wire us. Northwest Plastics, Inc. 2233 University Ave., St. Paul 4, Minnesota.

ARMY ORDNANCE AWARD

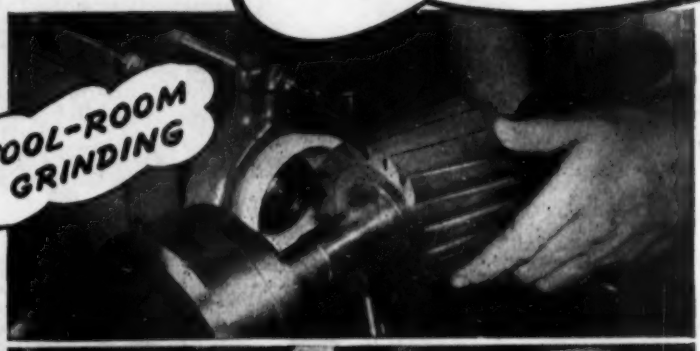
FOR MERITORIOUS PRODUCTION

Compression molding • Transfer molding • Injection molding • Extrusion molding
Modern Tool and Die Department • Finishing, Fabricating and Assembling Department
Laboratory for Development and Production Control • Engineering and Product Design

NORTHWEST PLASTICS inc.

THERE IS A PRODUCT BY "CARBORUNDUM" FOR EVERY ABRASIVE APPLICATION!

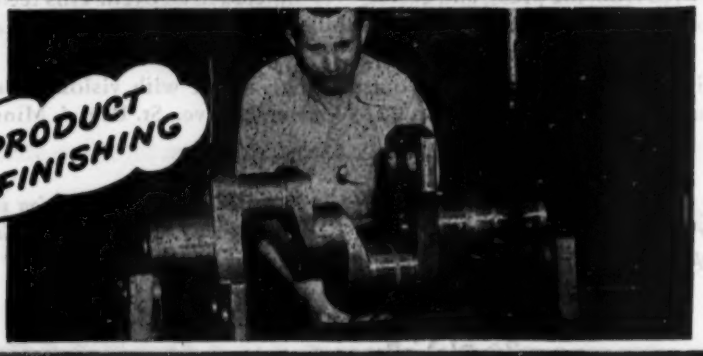
TOOL-ROOM GRINDING



CENTERLESS GRINDING

CENTER-TYPE GRINDING

PRODUCT FINISHING



YEARS of skilled research and experience by "CARBORUNDUM" Abrasive Engineers have led to the finest, most complete line of abrasive products on the market — abrasives that give you the maximum in efficient production at the lowest possible cost. Consult our nearest office to obtain the right abrasive product by "CARBORUNDUM" to meet your particular requirements.

The Carborundum Company,
Niagara Falls, New York.

THERE IS A PRODUCT BY

CARBORUNDUM

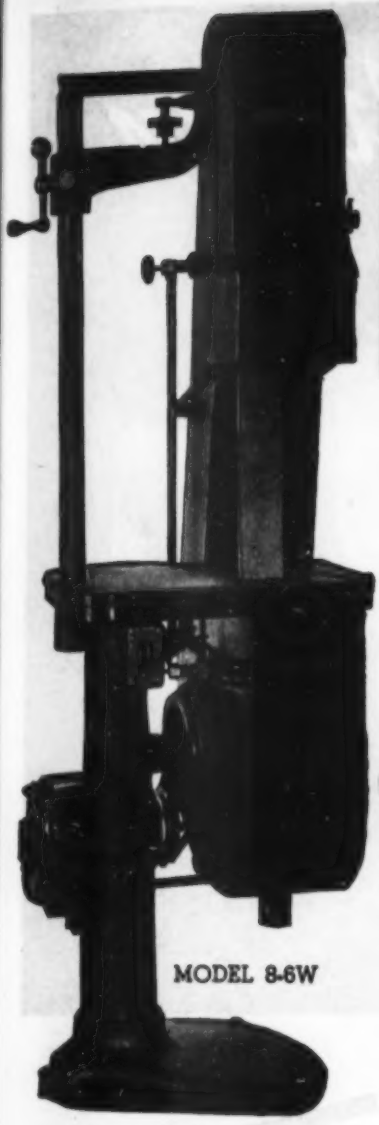
TRADE MARK

FOR EVERY ABRASIVE APPLICATION

("CARBORUNDUM" is a registered trade mark of and indicates manufacture by The Carborundum Company)

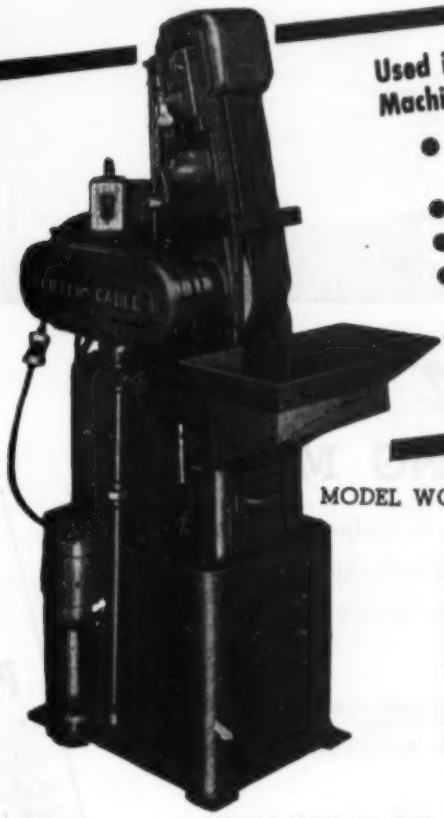
For Your SALVAGE OPERATIONS

Often the whole profit and loss picture depends upon your Salvage operations. The department handling that part of the job must have equipment that will salvage most of your rejects. The PORTER-CABLE Wet-Dry Belt Surfacer is versatile and adaptable to many requirements of the Salvage operation. In one machine you get a Wet Belt for Thermo-plastics; a Dry Belt for Thermo-Setting Plastics! It is adapted to flash, fin, and gate removal; finishing rough spots; and scores of other machining operations!



MODEL 8-6W

MODEL WG-8



MODEL WG-4

Used in Production, This Better Machining Will Lower Your Salvage Quota

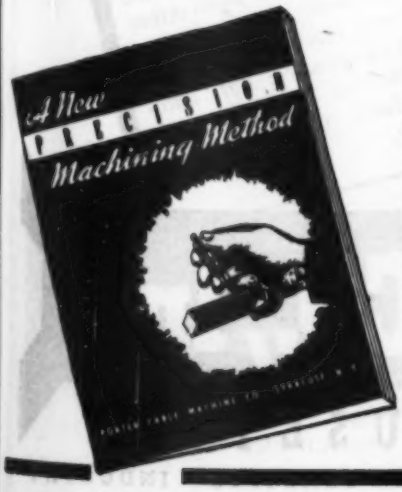
- Eliminates Flow—Discoloration—Warping—Dust!
- Smooths Molded Defects!
- Holds Contour!
- Gives all-over finish to spheres and cylinders!
- Requires less operator training!
- 5 to 25 times faster than many common methods!

★

PORTER-CABLE MODERN SURFACERS

There's a PORTER-CABLE machine that will bring the savings and efficiencies of Wet-or-Dry Belt Surfacing to any operation you may encounter. Models are now available with Hydraulically controlled, Micrometer-Stop Adjustment Automatic Feed Tables—piling huge operational savings on top of those already effected by this new Surfacing technique.

★



The Porter-Cable Wet-or-Dry Belt Surfacer is as revolutionary in concept as the Plastics industry itself! Ask for your FREE copy of this important book.

PORTER-CABLE MACHINE CO.
1606-7 N. Salina St.
Syracuse 8, N. Y.

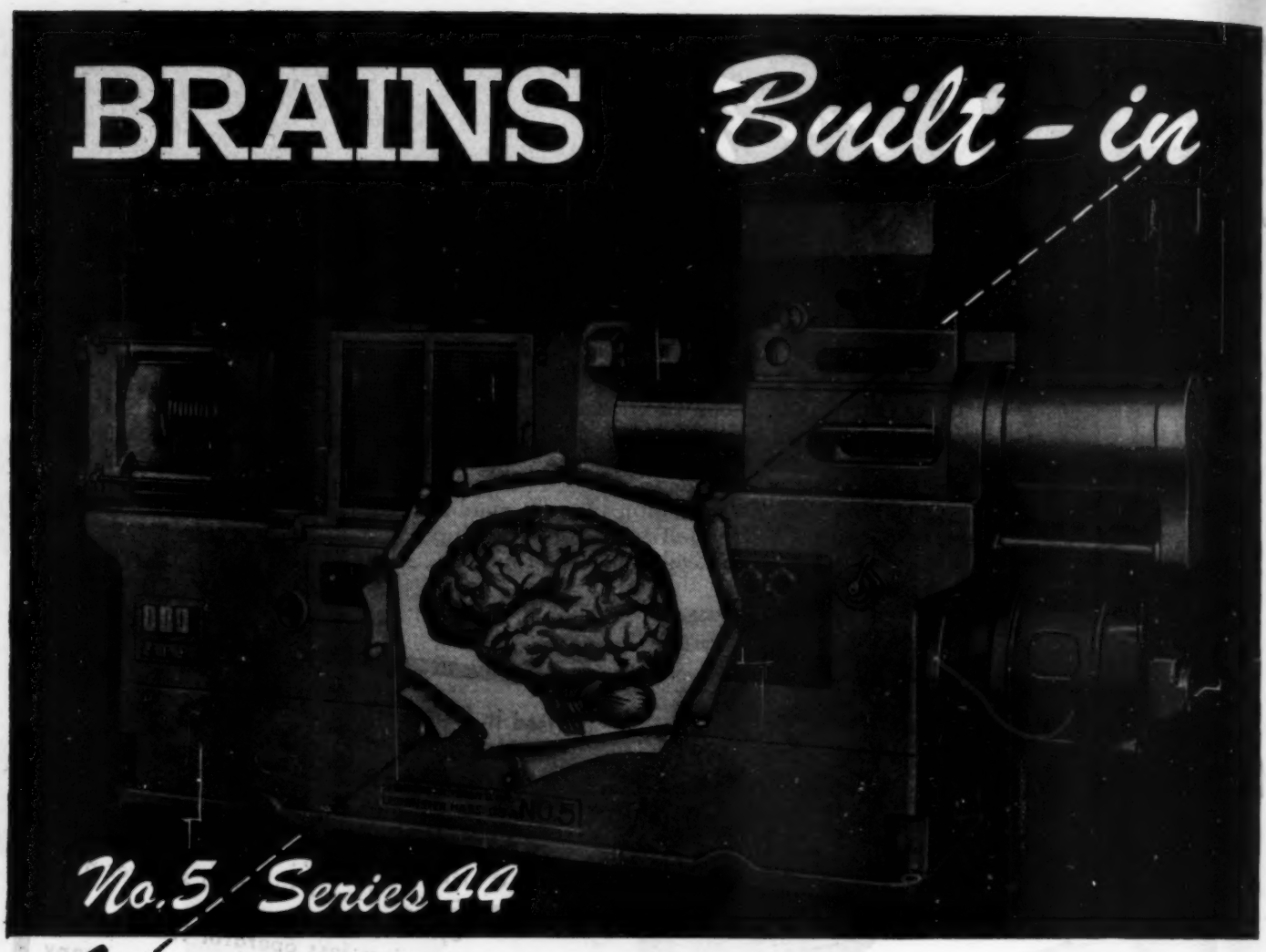
I'd like to learn more about this modern machining method. If you'll send me a book, I'll read it!

Name ..... Title .....

Company ..... Street .....

City ..... State .....

BRAINS *Built-in*



Leominster

INJECTION MOLDING MACHINE

New precision die-alignment, achieved by one adjustment of a single screw, eliminates multiple die adjustment and resultant inaccuracies. This improved adjustment control prevents flooding, reduces rejects to minimum.

"Central-shaft" centralized movable plate support equalizes pressure distribution, and full length pin support in the heavy-duty toggle assembly gets rid of toggle trouble.

Uniform thrust action of the multiple knock-out pin system prevents cramping, breakage and wear of ejection parts.

For Precision Production, Speedy and Safe—Depend on Leominster

2 Independent SAFETY Factors Protect The Operator

Machine cannot function while *either* door is open, or when either of the two independent safety controls becomes inactive. Thus utter protection of operator, and "automatic insurance" are effected. Front and back guard doors open individually.

LEOMINSTER TOOL CO., Inc.

LEOMINSTER, MASSACHUSETTS

MANUFACTURERS OF MACHINES AND MOLDS FOR THE PLASTICS INDUSTRY

	FEATURES	Airtronics	Preheater "A"	Preheater "B"	Preheater "C"
1	**DUAL LOAD SELECTION** — two independent sets of timer and power controls.	✓			
2	**AUTOMATIC POWER REGULATION** — constant power is maintained during heating interval.	✓	✓		
3	**AUTOMATIC LOAD CIRCUIT TUNING** — preheater efficiency is maintained at maximum regardless of changes in material characteristics.	✓			
4	**INPUT VOLTAGE REGULATION** — compensates for variations in line voltage over 200-240 volt range.	✓	✓		✓
5	**DESIGNED FOR *CONTINUOUS* OPERATION** — tubes, transformers and all other components operate at conservative ratings for *continuous* service, insuring minmum operational failures.	✓			
6	**STEPLESS POWER CONTROL** — permits easy, accurate pre-setting of power output at desired level.	✓	✓		
7	**CONTROLS CONVENIENTLY PLACED** — timer and power controls accessible to operator if minor adjustments are needed.	✓	✓		
8	**SELF-ALIGNING OUTPUT ELECTRODES** — insure equal distribution of electro static field and heating.	✓			✓
9	**ADJUSTABLE AIR GAP** — provides either contact or air gap between upper electrode and preforms.	✓			
10	**WIDE RANGE OF APPLICATION** — special electrodes available for preforms of unusual shape.	✓		✓	
11	**PREFORMS IN FULL VIEW** — preforms are visible at all times to the operator.	✓	✓	✓	
12	**UPPER ELECTRODE INTERGRATED WITH HOOD SHIELD** — when shield is raised, upper electrode rises and retracts; when shield is lowered, upper electrode descends to operating position.	✓	✓		

THE *Only* PREHEATER THAT HAS *all* THESE ADVANTAGES

AIRTRONICS
MODEL DE

All of these advantages add up to *Faster, Better, Simpler* preheating. Consult the AIRTRONICS Sales engineer nearest your plant for the engineering details and how you can use AIRTRONICS to speed your production schedule, or send for the *new* folder that completely describes this high-production preheater. Write Dept. MP.

Airtronics MFG. CO.

CHICAGO, 407 S. Dearborn Zone 5 — NEW YORK, 31-28 Queens Blvd. Long Island City, Zone 1 — LOS ANGELES, 5245 W. San Fernando Rd. Zone 26

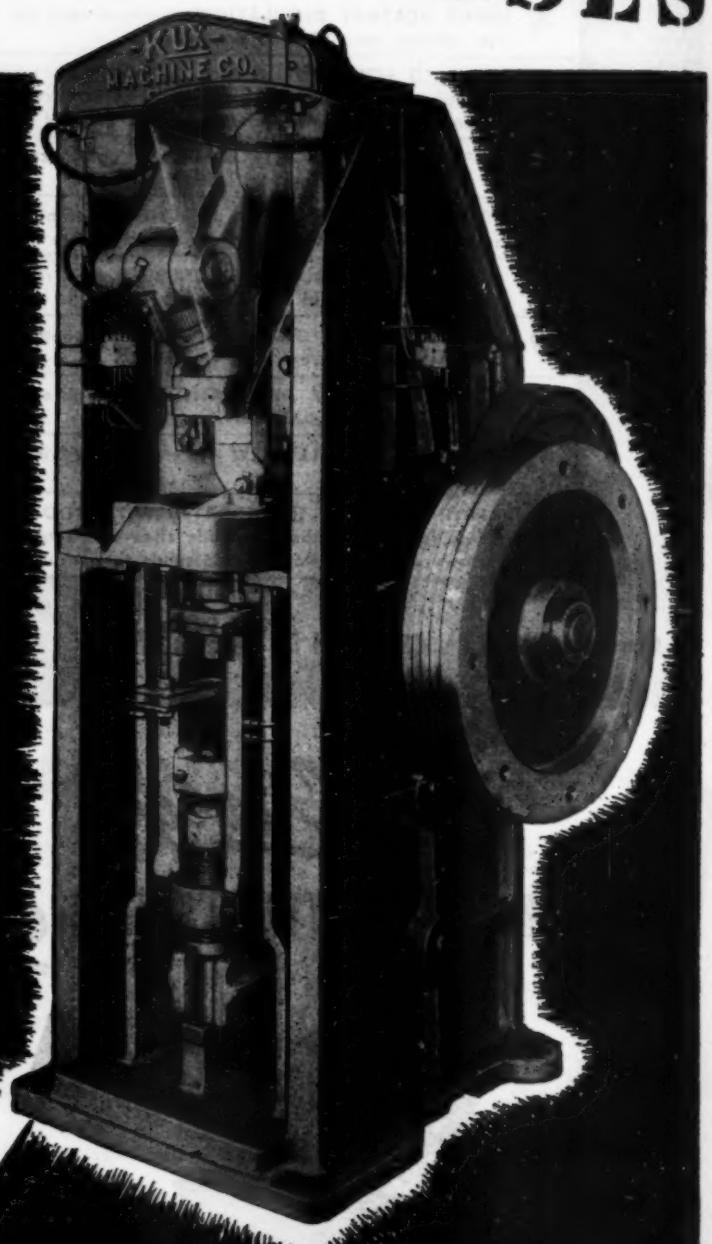
STURDY

KUX PREFORM PRESSES

The new massive Model 65 produces preforms 3" diameter, has a 3" die fill and applies 75 tons pressure

This rugged preform press with its heavy duty, one-piece cast steel main frame will produce odd shapes as well as round preforms. The pressure applied by both top and bottom punches results in more solid, dense preforms, which have less tendency to crumble or break during handling. This new Model 65 press is built to safely withstand high pressures of up to 75 tons at top production efficiency.

Choice of a complete size range of machines in both single punch models and multiple punch rotaries is also available.



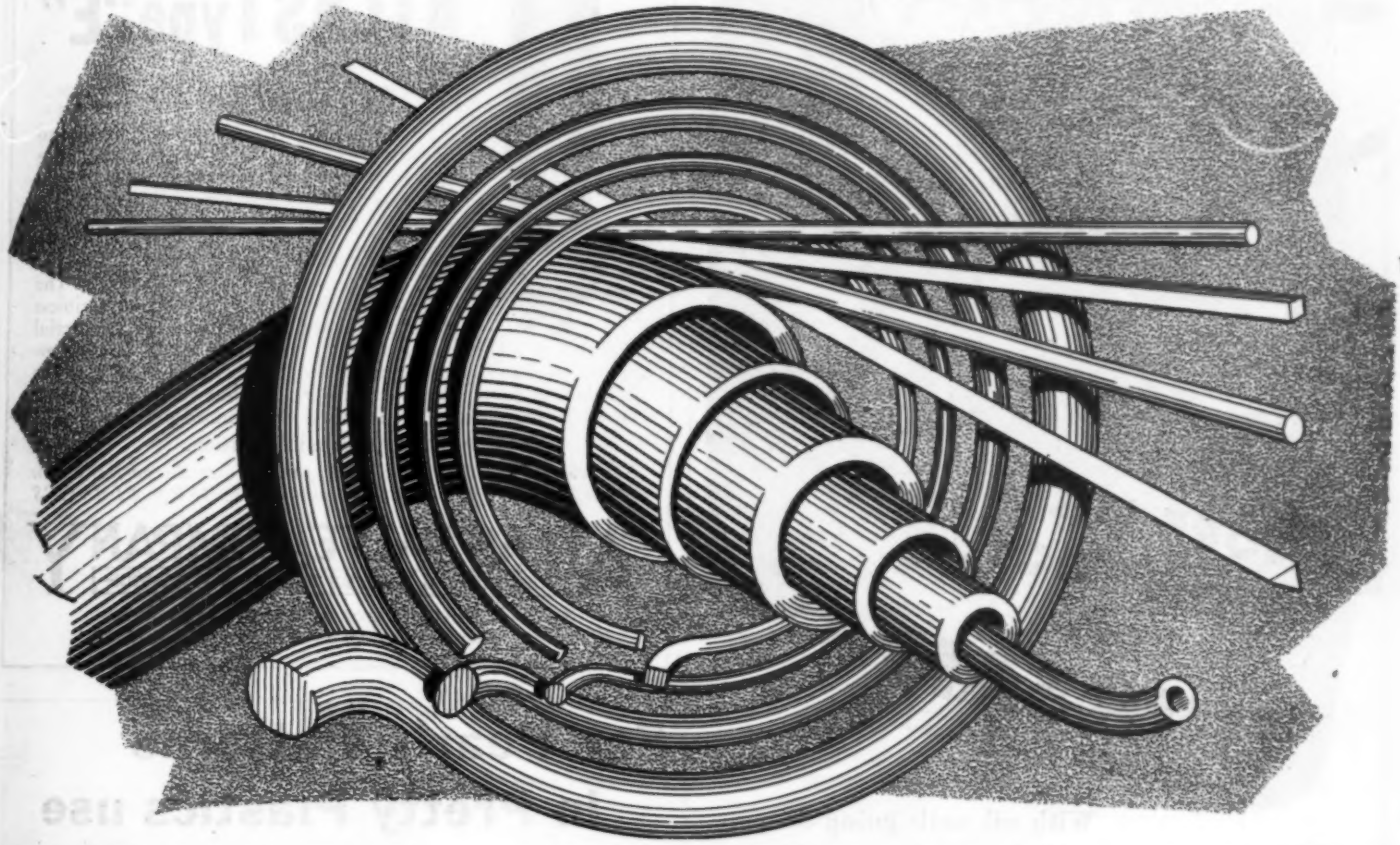
WRITE DEPT. P FOR NEW CATALOG OR DEMONSTRATION

KUX MACHINE COMPANY

3924-44 WEST HARRISON STREET • CHICAGO 24

FLEXIBLE OR RIGID

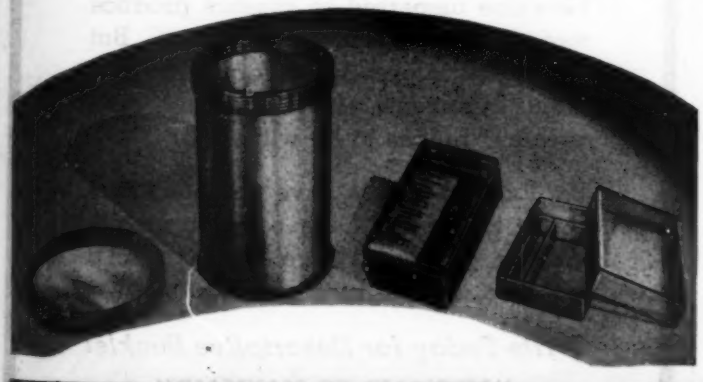
TUBING — TAPE — THREAD — RODS — SHEETS
and SPECIAL SHAPES



EXTRUSION *and* INJECTION MOLDINGS

Extrusion Moldings, made by the mile in all diameters and thicknesses; clear and in any colors, under capable supervision and expert Technical skill.

INJECTION Moldings in sizes up to 9 ounces per shot, simple or intricate forms, in all types of thermoplastics.



An expert Engineering Staff is available to you . . . .

CELLUPLASTIC CORP.

CELLUPLASTIC CORPORATION

44 AVENUE L NEWARK, N. J.

WEST COAST REPRESENTATIVES: CONTAINER SERVICE CO., 1266 North Western Avenue, Los Angeles 27, Cal.

CHIKSAN
Formula for Perfect Flexibility:

$$BB_2 + EP = \frac{P/V}{LT}$$

BB_2 = Double Rows of Ball Bearings.
EP = Effective Pack-Off
P/V = Pressure or Vacuum
LT = Low Torque

With oil wells going deeper and deeper, it may not be long until depths are stated in miles... not feet! Drillers get more miles of service per foot of rubber rotary hose by using a CHIKSAN *Ball-Bearing* Swivel as end connection (shown in photo above). You can protect your rubber hose and make it last longer, too, by using Chiksan Swivels for connection to gas, oil, air or water outlets ...and on all hose reels. Over 500 different types, styles and sizes for every purpose. Write for Catalog.

Representatives in Principal Cities. Distributed Nationally by CRANE CO.

CHIKSAN BALL BEARING SWIVEL JOINTS FOR ALL PURPOSES
CHIKSAN COMPANY
BREA CALIFORNIA

INVESTIGATE
This High Pressure Reducing Valve

If you are one of those who thinks that "all reducing valves are alike," we suggest that you thoroughly investigate

ATLAS Type "E"

shown at the left. This valve is "different." It reduces pressures as high as 6000 psi—oil, water, or air—*without shock*. Thanks to investigations by others it is now being used in most of the leading plastics plants, and we receive orders for additional valves nearly every day.

How about its construction? Well, the body of the valve is of forged steel. The internal metal parts are entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

Ask for complete information.

For other ATLAS plastics plant products see the partial list in our ad in the January 1945 issue of MODERN PLASTICS

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
277 South Street, Newark 5, N. J.
Representatives in principal Cities

For Pearly Patterns in Pretty Plastics use
IVANO GUANINE

All plastic manufacturers know that Guanine dispersed in plastics produce varied and arresting patterns. But every plastic presents different requirements in solvents, and temperatures and pressure ranges to be withstood.

So, for best results have your Guanine made to order. Give us your specifications, and we'll give you a special guanine, custom built for **you.**

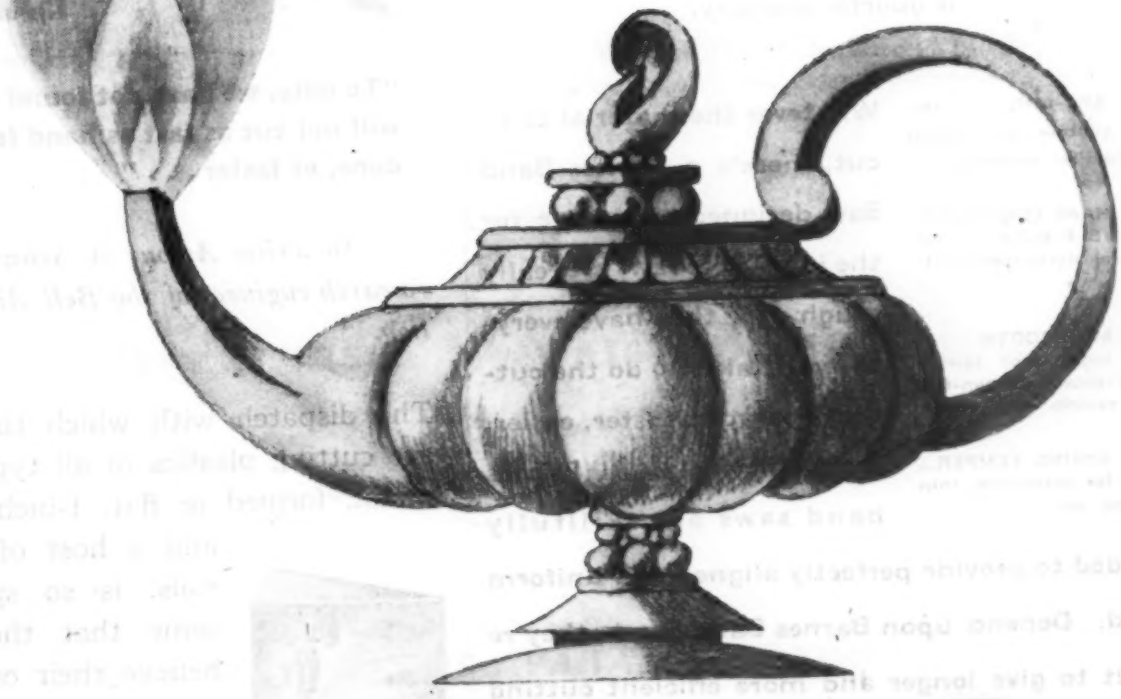
Write Today for Descriptive Booklet
"MERMAID TO MANMAID"
Fine Chemicals Division

IVANO
INCORPORATED

166-184 Commercial St., Malden 48, Mass.

Sincerity of purpose
is the great tool in superior production

GMP



Molders of Plastics

SOCIETY OF THE PLASTICS INDUSTRY · SPI

GENERAL MOLDED PRODUCTS · INC
GENERAL OFFICE AND PLANT AT DES PLAINES • ILLINOIS

PLASTICS and LIGHT METALS CUT FASTER, EASIER

with BARNES BAND SAWS

. . . produced in Barnes' modern plant devoted exclusively to the manufacture of saws for over a quarter century.

★ ARC-LINE . . . for contour, die-cutting and similar operations.

★ HARD EDGE FLEXIBLE BACK . . . for general all-purpose cutting.

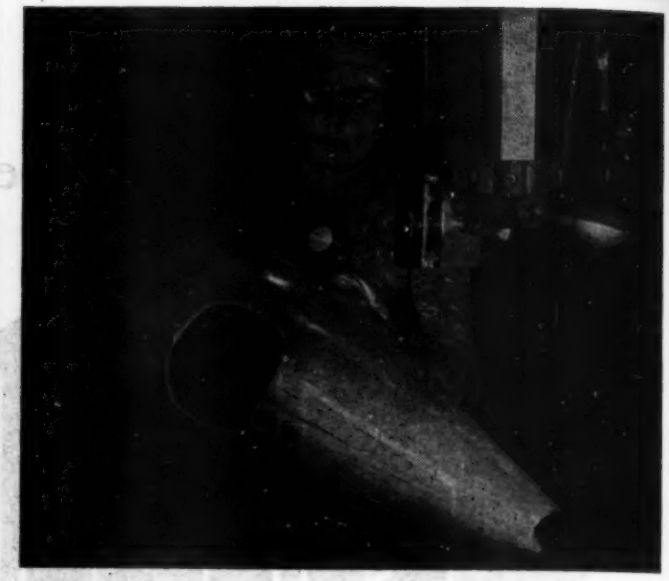
★ SKIP TOOTH . . . high speed sawing of plastics, soft non-ferrous metals, wood, etc.

★ SPRING TEMPER... for aluminum, thin tubing, etc.

Whatever the material to be cut, there's a Barnes Band Saw designed and made for the job. These saws are really tough . . . they have everything it takes to do the cutting operation faster, easier, more efficiently. All Barnes band saws are skillfully welded to provide perfectly aligned and uniform weld. Depend upon Barnes Band Saws—they're built to give longer and more efficient cutting service.

Call your Mill Supply Distributor— he carries a complete stock of all Barnes Band Saws.

ESTABLISHED 1919
W. O. BARNES CO., INC.
DETROIT 14, MICHIGAN



Friction Sawing with Tannewitz HIGH SPEED BAND SAWS

"To date, we have not found any plastic it will not cut as fast as hand feeding can be done, or faster . . ."

. . . So writes Arthur A. Schwartz, chief tool research engineer of the Bell Aircraft Corporation.

The dispatch with which these machines are cutting plastics of all types as well as metal, formed or flat, 1-inch armor plate and a host of other materials, is so spectacular to some that they refuse to believe their own eyes. By all means get acquainted with them. Write for your free copy of "FRICTION SAWING" — by Arthur A. Schwartz.

Write for Your Copy

THE TANNEWITZ WORKS
GRAND RAPIDS 4, MICH.

PROVED BY WAR

FOR IMPROVED PEACETIME PRODUCTS . . .

DURITE

P L A S T I C S

RESINS

THERMOSETTING PHENOL-FURFURAL AND PHENOL-FORMALDEHYDE TYPES

ADHESIVES

THERMOSETTING AND COLD-SETTING

THERMOSETTING CEMENTS

FOR METAL-TO-METAL AND OTHER APPLICATIONS

MOLDING COMPOUNDS

OIL SOLUBLE RESINS

WATER SOLUBLE RESINS

NEW PROCESSES

OUR EXPERIENCE IS AVAILABLE TO YOU

DURITE PLASTICS

INCORPORATED

FRANKFORD STATION P. O. PHILADELPHIA 24, PA.

REPRESENTATIVES LOCATED AT:

3838 Santa Fe Ave., Los Angeles 11, Cal. — 1274 Folsom St., San Francisco 3, Cal. — 67 Lexington Ave., Buffalo 9, N. Y. — 4226 Cedar Springs, Dallas 4, Texas

352 Plymouth Road, Union, New Jersey — 245 W. Franklin St., Morrisville, Pa. — 2711 Olive St., St. Louis 3, Mo. — 4851 S. St. Louis Ave., Chicago 32, Ill.

Plastack

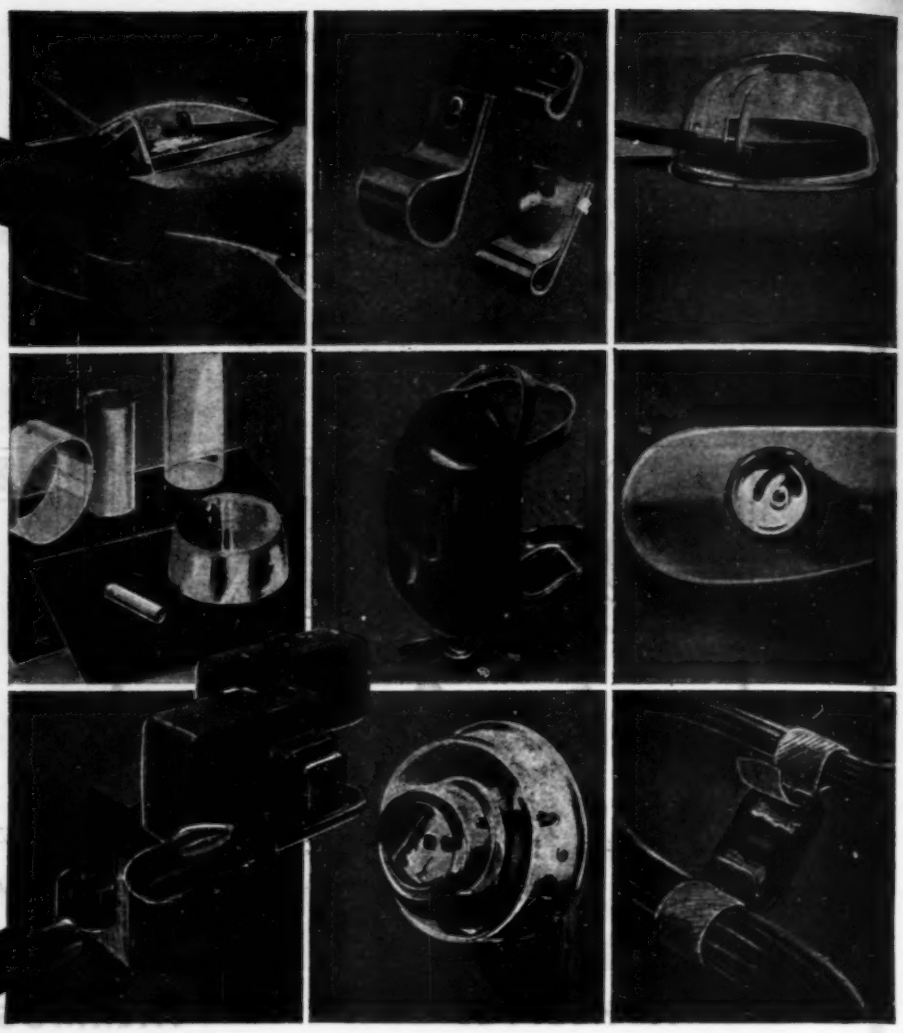
1. Aircraft Cockpit Enclosures. 2. Loop Type Supports for Wires and Tubes. 3. Aircraft Turret Blisters. 4. Transparent Thermosetting Sheets, Rods, Tubes, and Castings. 5. Welder's Protective Lenses and Goggles. 6. Heat Resistant, Clear and Colored Light Lenses. 7. Lucite Meter Cases and Transparent Machinery Housings. 8. Strap Type, Quick-Release Wire Support.

From these precision made products at war today comes Stacks precision correct products for better living tomorrow.

Let Stack develop your postwar ideas.

STACK Plastics

5835 West Washington Blvd. Culver City, California



COTTON DUCK

for

Laminators and Molders

Our Southern mills have made high tensile cotton fabrics for the Plastics industry for [illegible] years and specialize in cotton textiles for over [illegible] years. Our experienced [illegible] and production [illegible] are at your service.

Curran & Barry

320 BROADWAY NEW YORK CITY

PLASTIC MOLDS

25 years experience in designing and building molds for leading molders.

Our plant is modern in equipment for producing the best in molds. Compression, Injection, Transfer.

SOCIETY OF THE PLASTICS INDUSTRY

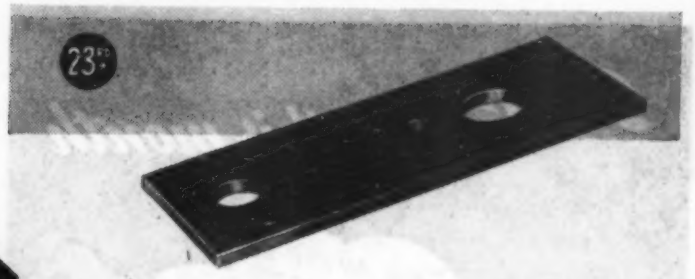
FORTNEY MFG. CO.

247 N.J. R.R. Ave.

NEWARK 5, N. J.

Aico

PRECISION MOLDED FOR ACCURACY



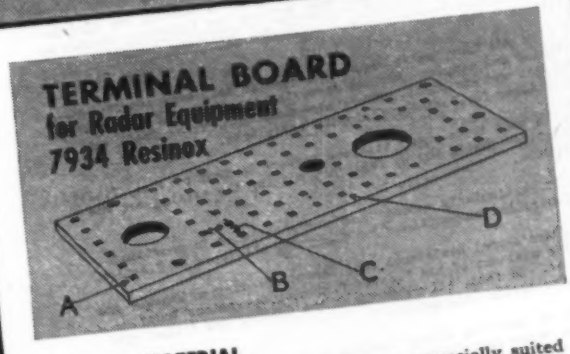
M.P.* on duty in the South Pacific

THIS **molded plastic* terminal board is guarding the efficient operation of radar equipment against attack by tropical fungus.

Like many other wartime plastic applications, it is helping reduce maintenance time by increasing dependability and efficiency of component parts.

It is manufactured from material carefully selected for the necessary electrical and chemical properties, and is expertly molded to excel in performance.

Requirements of the part design make this an unusually difficult piece to produce. But, in more than 29 years of precision molding, Aico has gained the technical skills and mastered those processes which are demanded to produce intricate parts to rigid specifications.



7934 RESINOX TERMINAL BOARD RADAR

MOLDING MATERIAL

7934 Resinox, a mineral-filled phenolic, is especially suited for use in electrical equipment, having high dielectric strength and good power factor. Adequate tensile and flexural strength and excellent resistance to chemicals, water and heat are other requirements met by this material.

MOLD DESIGN

This plastic part is produced in a 2-cavity semi-automatic compression mold. Square holes (A) must be accurate and uniform in size and held to close tolerances as to size and position. Distances (B&C) between holes must be uniform in every case.

MOLDING PROBLEMS

Difficulties of molding this part arise from the design requirement of the numerous small square holes (A). Pins in the female mold, which form the holes, must be kept in perfect alignment to match the holes in the male mold. Sharp corners (D) in square holes were difficult to mold because they restrict material flow. Strains set up in molding have a tendency to cause cracks at the corners (D) of these square holes (A) making the part difficult to produce. Aico, with thorough knowledge of molding techniques, overcame these difficulties to produce a strong, accurately molded part that meets all functions and physical requirements.

**Send a request on your letterhead for Aico's file card series, Nos. 1 to 23, covering a wide variety of plastics applications.*

Aico

AICO

PRECISION MOLDING

29th Year

AMERICAN INSULATOR CORPORATION

NEW FREEDOM, PA. Sales Offices: Boston • Bridgeport • Cleveland Detroit • New York • Philadelphia

Sorry—no ad this month

McALEER MANUFACTURING CO.

CABLE ADDRESS "LACPOLISH" — Quality Controlled — Manufacturers of AUTOMOTIVE • HOUSEHOLD • INDUSTRIAL Finishing Materials — ROCHESTER, MICHIGAN

Mr. James H. Connors
Modern Plastics
221 N. La Salle Street
Chicago 11, Illinois

May 1, 1945

Dear Jim:

Sorry — there'll be no McAleer ad this month.

Not only have we been "up to our ears" producing war finishing materials, but — we've been busy putting the finishing touches on our latest Catalog of Polishing, Buffing and Deburring Compositions. Wait 'till you see it!

As you know, we've been privileged to help many manufacturers solve varied and complex problems involving the finishing of all kinds of precision war equipment. These same manufacturers we feel, will look to McAleer for Post-War finishing assistance.

We want to be ready with the answers to most of their finishing problems — that's why we feel that getting the catalog out NOW is important.

It particularly embodies our war experience in providing Quality-Controlled compositions for finishing all types of Plastics.

There's real assistance too, for the Production Manager who must get the most out of his Plastic finishing operations today — and tomorrow. In fact, all 20 pages of the Catalog are filled with cost-and-time-saving information.

We're reserving a copy for you — and we'll distribute as many more as paper restrictions permit. When we announce the catalog to the Trade next month, the demand is sure to exceed our supply — so, don't delay — send us the names of those whom you know need a copy.

Kind regards.

Sincerely Yours,
M. E. Gardner
M. E. Gardner, Manager
Industrial Finishing Division

FOR FAST ACTION, if the products you use or make are derived from the base materials below, send samples of work or an outline of what you want in the way of finish. We'll take it from there.

PHENOL-FORMALDEHYDES • UREA-FORMALDEHYDES • ACRYLATES and METHACRYLATES STYRENES • HARD RUBBERS • CASEINS • ETHYLCELLULOSES • CELLULOSE ACETATES • CELLULOSE ACETATE BUTYRATES • CELLULOSE NITRATES

McAleer MANUFACTURING CO.
Quality-Controlled Finishing Materials
ROCHESTER, MICH.
PLASTICS FINISHING DIVISION

THE PIONEER
IN DECORATION ON
GLASS AND PLASTIC
CONTAINERS

Anigraphic Process Inc.

- 4 colors in 1 operation
- Finest detail—line or halftone.
- Water and alcohol resistant.

WHitehall 3-5253 — 11 Broadway, New York 4, N.Y.

GOOD PLASTICS
are better than
ALIBIS . . .

When you provide Cambridge Mold Pyrometers for your molders, there need be no alibis for rejects caused by incorrect molding temperatures. Soft centers, off-colors, warpage and low tensile strength are usually traceable to this cause. With this instrument, it is both quick and easy to determine accurately the surface temperature of each cavity in the mold. The *Cambridge* is an accurate, rugged, quick-acting instrument that takes the guessing out of molding plastics. Write for bulletin 194SMP.

BUY WAR BONDS

Cambridge Instrument Co., Inc.
3732 Grand Central Terminal, New York 17, N.Y.

CAMBRIDGE
Mold ★ Surface ★ Needle
Combination and single purpose instruments
PYROMETERS

Bulletin 194-S gives details of these instruments. They help save money and make better plastics

Have YOU Considered

ALLYL ALCOHOL and ALLYL CHLORIDE

as raw materials for the synthesis of Polymerizable substances?

We have had the opportunity of working with many manufacturers of PLASTIC MATERIALS who are studying the possibilities in this field thoroughly. We are glad to offer YOU experimental quantities of these new chemicals and to supply general technical information regarding properties and uses.

Enlarge production facilities, which will permit lower prices on both ALLYL ALCOHOL and ALLYL CHLORIDE, are being built. Now is a good time to get YOUR ALLYL program under way.

Selling Agents for

SHELL CHEMICAL

Division of

SHELL UNION OIL CORPORATION

R.W. GREEFF & CO.

10 ROCKEFELLER PLAZA
NEW YORK CITY

TRIBUNE TOWER
CHICAGO, ILL.

HOW MISKELLA INFRA-RED OVENS AND APPLIANCES SERVE THE PLASTIC INDUSTRY

Branch of the Industry	Name of Appliance	Use
Molders (Thermo-setting) Compression	PELLET-VEYOR (Variable heat)	To preheat pellets and preforms at the press as needed
Molders (Thermo-plastic) Injection	VIBRA-VEYOR (Variable heat)	To preheat plastic powder automatically. To dry plastic powder automatically
Injection	HOPPER-HEATER (Variable heat)	To warm up heavy metal of hopper of molding machine
Molders (Thermo-plastic) Extrusion	STRIP-HEATER (Variable heat)	To preheat strip rolls of vinylite, etc., automatically as fed to worm
Material Manufacturers	Special production equipment including vibrators, conveyors, stainless steel belts and electronic devices	To process various kinds of plastic material in bulk
Fabricators (Miscellaneous)	BENCH-KIT In various sizes (Variable heat)	To soften sheets, rods, tubes and any shape for bending, forming, punching, etc. This includes Cellulose, Acetate, Methyl Methacrylate

(The time on most of the operations mentioned above averages five minutes)
We sell lamps and build completely engineered Infra-red equipment and appliance installations.

Drying, Baking, Processing and Preheating Specialties

INFRA-RED ENGINEERS & DESIGNERS

MANUFACTURERS
Main Office and Laboratory
1637 East Fortieth Street, Cleveland, Ohio

The Gauntlet Lives on, and on!

A new "strong-arm" helper for workers in PLASTICS: Jomac offers its Safety GAUNTLET-CUFFS . . . and licks an ages-old problem of waste! The Safety *Gauntlet-Cuff* is a separate piece, an extra-strong covering for the worker's forearm. The worker merely adds new gloves to the Safety *Gauntlet-Cuffs* and once again has a gauntlet-type glove. Jomac Safety *Gauntlet-Cuffs* and Jomac Gloves . . . a great *economy-team!*

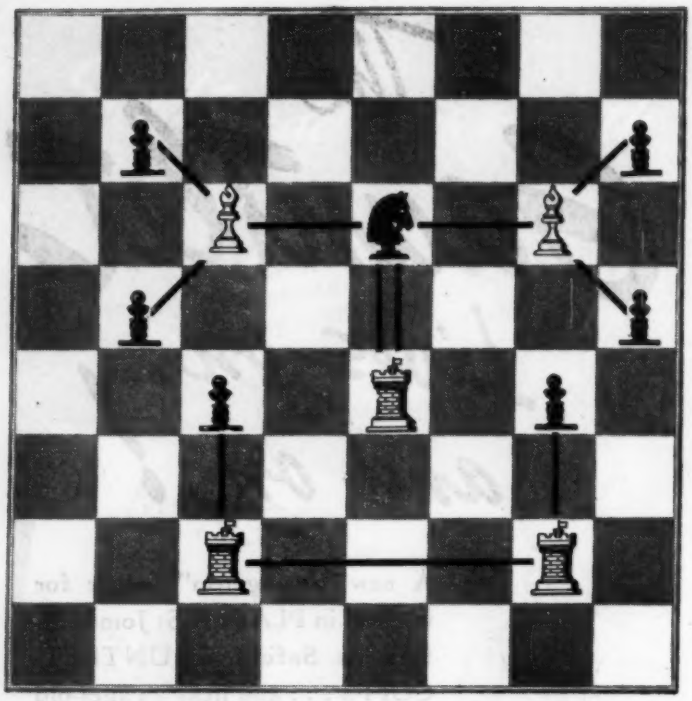
JOMAC *Safety Gauntlet-Cuffs*

By the Makers of the Famous JOMAC Industrial Gloves

SEE THEM WORK! Test these new Jomac Safety *Gauntlet-Cuffs* in your own plant. Check them for their easy workability, their economy. Write for details. C. WALKER JONES CO., Philadelphia 38, Penna.

THREE TYPES OF JOMAC GLOVES

- Regular Industrial Type
- Heat- and Flame-Resisting
- Safety Gauntlet-Cuffs



Plan your next move with BECCO UREA PEROXIDE

This is a ridiculous chess-board set-up, but it does represent an excellent formula—Becco Urea Peroxide, a white crystalline material containing 16 per cent active oxygen. It is very readily soluble in water and is also soluble in alcohols and certain other organic solvents. It possesses good storage stability. It contains water-free hydrogen peroxide.

It is available as crystalline powder or as tablets.

A FEW APPLICATIONS:

Used extensively for pharmaceutical and cosmetic preparations. Its outstanding characteristic of containing water-free hydrogen peroxide, makes it applicable as an oxidizing, bleaching and polymerization agent for use in non-aqueous systems.

The available supply of BECCO Urea Peroxide is limited at present.

ACTIVE OXYGEN IS ON ACTIVE DUTY

Other Becco Products:

Electrolytic Hydrogen Peroxide —100 vol. (27.5% by weight)
Ammonium Persulfate**
Potassium Persulfate
Magnesium Peroxide*
Calcium Peroxide*
Zinc Peroxide*
Pyrophosphate Peroxide*
Sodium Carbonate Peroxide*
Acetyl Peroxide*

**Available in research quantities only at present.*
***Will be available after the war.*

BUFFALO ELECTRO-CHEMICAL COMPANY, INC.

BECCO
SALES CORPORATION
SALES AGENTS BUFFALO 7, N. Y.

INDIA

Well established and financially sound European-owned and controlled firm with own sales and distribution organization throughout India is open to consider sole representation for marketing sundries, all kinds of plastic products, etc. Apply in first instance to

WILLIAM GRIMSHAW & SONS
BANK OF BARODA BUILDING
APOLLO STREET BOMBAY

PHENOPREG

Molding Materials

PHENOPREG MOLDING MATERIALS are available, in various forms, for molding and laminating.

SHEET STOCK—We can furnish Phenopreg materials cut to your specifications and packed with separator sheets.

ROLLS—Standard roll weight is 100 pounds. Other roll weights can be furnished on specification. These can be slit to specific widths, if so specified.

COIL CHARGES—We can furnish Phenopreg materials in coils, wound to your specification, so that each individual coil constitutes an individual cavity charge for the production of molded laminated parts.

DIE-CUT PATTERNS—We can die-cut any of our grades to your particular blueprint or template for assembly of individual preform assemblies in the molding of curved fabrications.

PHENROK

We have available standard grades of Phenrok laminated sheet stock in any of the NEMA Grades.
We invite your inquiries on any of the above materials.

DWPC
Vinewood 1-8200
DETROIT WAX PAPER CO.
PLASTICS DIVISION
1721 Pleasant Avenue, River Rouge 18, Michigan

WE BUY, SELL, PROCESS

PLASTICS SCRAP

ACETATE BUTYRATE VINYLS POLYSTYRENE ACRYLICS

H. MUEHLSTEIN & Co. INC

122 EAST 42nd STREET, NEW YORK 17, N. Y.

LOS ANGELES · BOSTON: 31 St. James Ave.

MacRae's DOES A GREAT JOB · MacRae's
MacRae's Blue Book
ECONOMY FUSES CLEARSITE
For advertising and book rates consult your agency or write
MacRae's Blue Book
A DIRECTORY OF AMERICAN INDUSTRY
30 E. HURON STREET CHICAGO 11, ILL.

GLYCERINE

...quickly available

Armour's 332 stock points mean fast, dependable service

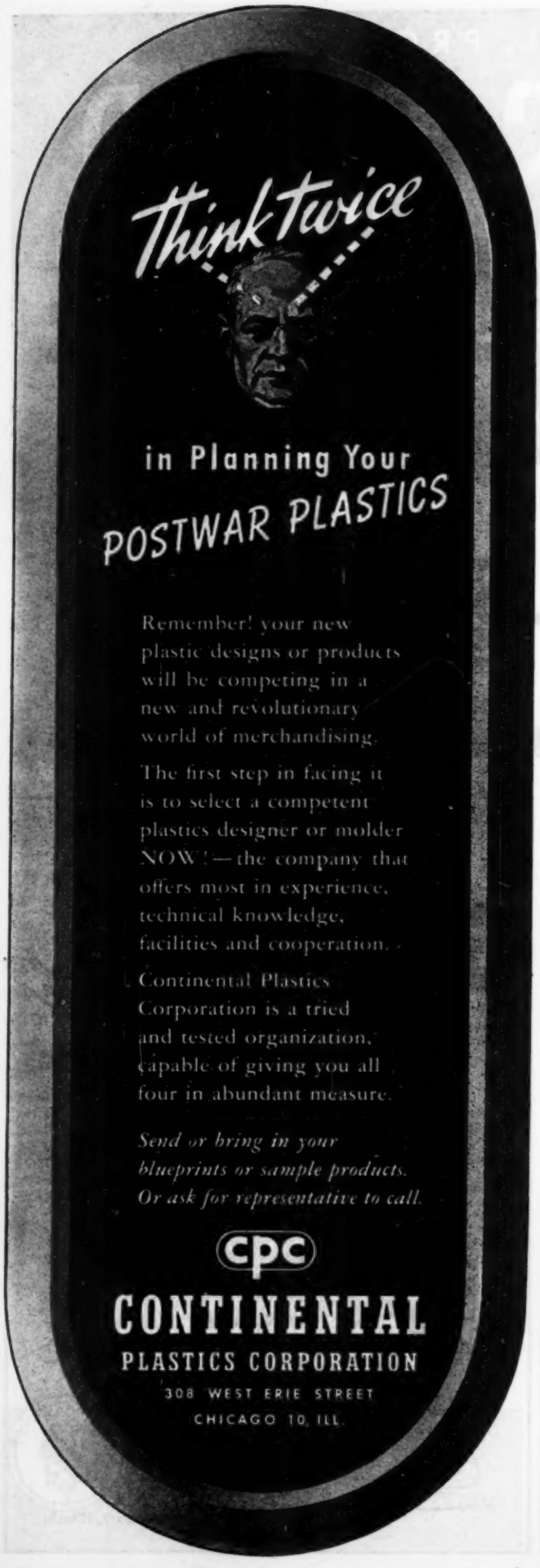
U. S. P.... A chemically-pure, water-white glycerine, meeting all requirements of the U. S. Pharmacopoeia . . . for use in foods, pharmaceuticals, cosmetics or any purpose demanding highest quality. Specific gravity, 1.249—25° C./25° C.

HIGH GRAVITY... A pale yellow industrial glycerine. Specific gravity, 1.262—15.5° C./15.5° C.

DYNAMITE . . . Made especially for the explosives trade. Specific gravity, 1.262—15.5° C./15.5° C.

ARMOUR AND COMPANY

1355 W. 31st St., Chicago 9, Illinois


Think twice
in Planning Your
POSTWAR PLASTICS
Remember! your new plastic designs or products will be competing in a new and revolutionary world of merchandising.
The first step in facing it is to select a competent plastics designer or molder NOW!—the company that offers most in experience, technical knowledge, facilities and cooperation.
Continental Plastics Corporation is a tried and tested organization, capable of giving you all four in abundant measure.
Send or bring in your blueprints or sample products. Or ask for representative to call.
cpc
CONTINENTAL
PLASTICS CORPORATION
308 WEST ERIE STREET
CHICAGO 10, ILL.

TIME
The great teacher

● It is probably truer in plastics than in any other industry that there is no substitute for experience. We have been molding plastics for 25 years—through the greatest period of change and expansion. Let our background serve you as it is serving many of America's leading industries.

SOCIETY OF THE PLASTICS INDUSTRY · SPI

KENILWORTH
PLASTICS MOLDING COMPANY
Division of Eureka Button Co. (Est. 1885)
KENILWORTH, NEW JERSEY

FACTS YOU NEED TO KNOW ABOUT MOULDED PLASTICS

● Certain plastics withstand heat better than others. Some are particularly adapted for jobs that must withstand wear. Others are best for machining and threading. ● The secret of success in plastics is in knowing the right plastic to use for the job at hand. ● Ask us to help you see what plastics can do in your business. ● Just send photo, sample or specifications, and we'll tell you quickly if it can be made in moulded plastics.

THE MAGNETIC PLASTICS CO.
1900 EUCLID BUILDING • CLEVELAND 15, OHIO

WORLD'S LEADING SCRAP GRINDER IN FORD MOTOR COMPANY PLANT

This is a typical installation of a Ball & Jewell #1 model rotary cutter. As the photo shows, this machine is used for grinding thermoplastic scrap back into re-usable molding powders. It is one of several machines used for this purpose in the Ford Motor Company plant, Dearborn, Michigan.

The Ball & Jewell machine is of extra heavy construction with solid tool steel knives and interchangeable screens for varied granulations. This installation utilizes a direct motor drive. The same machine is also available for belt drive.

BALL *and* JEWELL

20 Franklin Street, BROOKLYN, N. Y.

Since 1895, Manufacturers of Patent Rotary Cutters

or get in touch with nearest representative

CHICAGO: Neff, Kohlbusch & Bissel. DETROIT: J. C. Austerberry's Sons. LOS ANGELES: Moore Machinery Co. LOS ANGELES & SAN FRANCISCO: Machinery Sales Co. NEW ENGLAND: Standard Tool Co., Leominster, Mass. ATLANTA, GA.: George L. Berry. ST. LOUIS: Larrimore Sales Co. SEATTLE 4, WASHINGTON: Olympic Supply Co. KANSAS CITY, KANS.: Fluid Air Engineering Co.
LONDON, ENGLAND: Blackfriar's Engineering Co., Ltd.
AUSTRALIA and NEW ZEALAND: Scott & Holladay, Pty. Ltd., SYDNEY
STOCKHOLM, SWEDEN: Ingenjorsfirman Teknova.
CANADIAN AGENT: Williams & Wilson, Ltd., Toronto & Montreal, Canada
HAWAIIAN ISLANDS: Hawaiian Sales Service, P. O. Box 3498, Honolulu 11, T. H.

Photograph taken at Ford Motor Company plant is #7 in a series of advertisements showing typical Ball & Jewell scrap grinder installations.

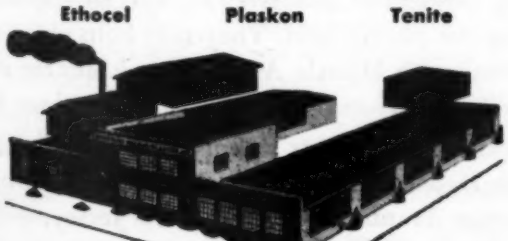
Experience Is the Answer to Plastic Problems

The molded plastic business cannot be learned over night as some people seem to believe.

In fact, the knowledge of properly molding each of the many different plastit materials requires years of actual experience. Each characteristic requires special handling learned from scientific research and actual production.

Because our organization is built around men of long experience we are able to obtain the finest results from any of the following materials:

Bakelite	Lumarith	Resinox
Durez	Lucite	Saran
Ethocel	Plaskon	Tenite



CUSTOM MOLDING

M

EXTRUSION
INJECTION
COMPRESSION

MICHIGAN MOLDED PLASTICS, *Inc.*
Dexter, Michigan

COTTON FABRICS

FOR REINFORCING

PLASTICS

★

J. H. LANE & CO., Inc.

250 W. 57th St. New York N. Y.

THERMOPLASTIC Scrap

BOUGHT—SOLD or RECLAIMED for You!

ACTIVE IN THE PLASTIC FIELD for 22 YEARS

A complete converting service! It will pay you to investigate our facilities for reworking your scrap.

CELLULOSE ACETATE—CELLULOSE BUTYRATE
STYRENE VINYL AND ACRYLIC RESINS

GP PLASTIC MATERIALS

A Dependable Source of Supply for re-worked Cellulose Acetate and Cellulose Butyrate molding powders

GERING PRODUCTS INC.

North Seventh St. & Monroe Ave., KENILWORTH, N. J. Chicago Office: 622 W. Monroe St.

EXTRUDED THERMO PLASTICS

★

Made to Order ONLY
No Stock Items
Details, Quotations — *Promptly*

Ameroid
Casein Plastics

IN RODS, DISCS, SHEETS AND PUNCHED FLAT SHAPES for fabricators. Non-inflammable, readily turned and machined. Wide color range.

AMERICAN PLASTICS CORP.
225 West 34th St. New York City 1

DO YOUR OPERATIONS INVOLVE

Joining Rigid Plastics

TO GLASS, METAL, WOOD, FABRIC, LEATHER OR OTHER PLASTICS?

Our research and Technical Staff is experienced in developing specialized adhesives for special applications, including the plastic field. They may help you to bond these joints with Miracle Adhesives *without the need for screws, clips or mechanical fasteners—and without heat.*

We can serve you best when you send full details to Research Department, Miracle Adhesives Corporation, 852 Clinton Avenue, Newark 8, New Jersey.

MIRACLE ADHESIVES

Get Easier Cutting and Longer Saw-Life

ON MAGNESIUM, ALUMINUM, PLASTICS, HARD WOOD

...use

SIMONDS

New "Skip-Tooth"

Hard Edge

Metal Band Saws

Soft materials like the light metals, plastics and wood all turn up extra-large chips when cut. So saws used in this type of cutting need extra-large gullets to clear these big chips... saws like Simonds Skip-Tooth Band Saws. This type of saw has coarse teeth . . . 2, 3, 4 and 6 per inch . . . yet the gullet is shaped so that even the narrower blades have maximum strength in the body, the teeth only being hardened. So you can bank on it that these new Skip-Tooth Saws will stay sharp so long that you'll get your money out of them long before they dull . . . which means you can economically replace with new blades and cut out all sharpening costs. See your dealer or write direct to Simonds.

BRANCH OFFICES: 1350 Columbia Rd., Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 228 First St., San Francisco 5, California; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash.

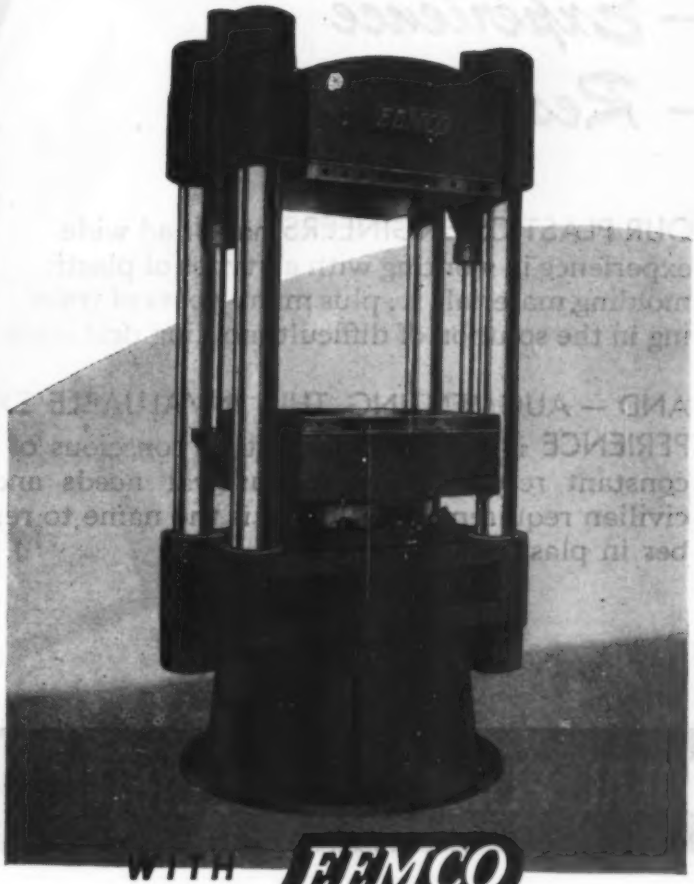
Cut the War Short, BUY WAR BONDS

SIMONDS

SAW AND STEEL CO.

FITCHBURG, MASSACHUSETTS

PLASTICS MOLDING



WITH **EEMCO**

HYDRAULIC PRESSES

PULL back or push back cylinders can be provided. Presses can also be supplied with double knockouts for the ejection of molded pieces. They are manufactured in sizes from the 12" x 12" laboratory press up to any desired size.

* * *

SALES REPRESENTATIVES

MIDWEST
HERRON & MEYER OF CHICAGO
36 South Dearborn Street
CHICAGO 3, ILL.

EASTERN
H. E. STONE SUPPLY CO.
OAKLYN, N. J.

OHIO
DUGAN & CAMPBELL
907 Akron Savings & Loan Bldg.
AKRON, OHIO.

Send for bulletins describing any of the following EEMCO Machinery:

MILLS
REFINERS
WASHERS
EXTRUDERS
STRAINERS
PRESSES
CALENDERS
TUBERS
CRACKERS

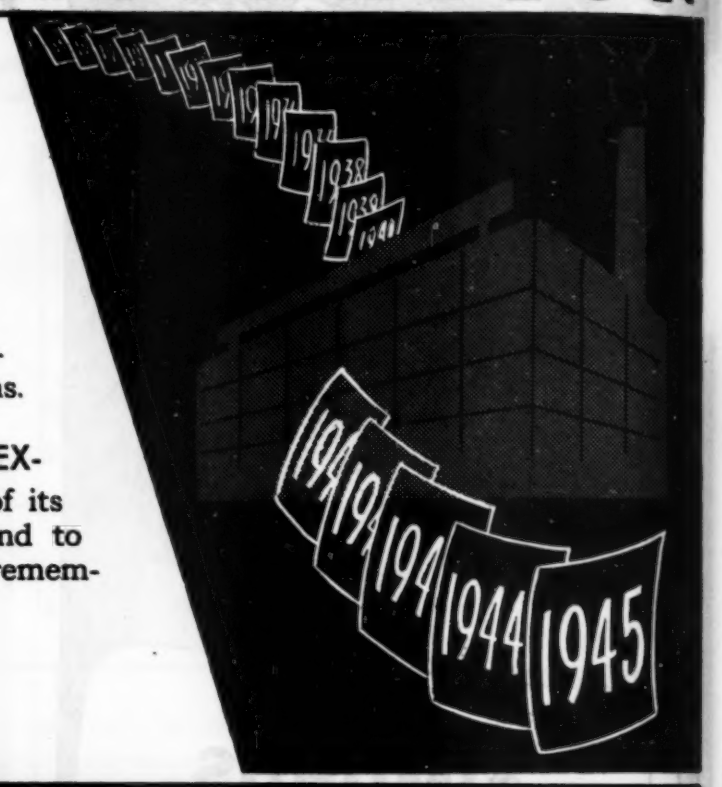
EEMCO

ERIE ENGINE & MFG. CO.

953 EAST 12th ST., ERIE, PENNA.

HAPPY COMBINATION

– Experience
– Responsibility



OUR PLASTICS ENGINEERS have had wide experience in working with all types of plastic molding materials . . . plus many years of training in the solution of difficult molding problems.

AND — AUGMENTING THIS INVALUABLE EXPERIENCE is a huge organization conscious of its constant responsibility to our war needs and to civilian requirements. "Ideal" is the name to remember in plastics.

Ideal

IDEAL PLASTICS CORPORATION A DIVISION OF IDEAL NOVELTY & TOY CO., INC. 23-10 43rd AVE., LONG ISLAND CITY, N. Y.

"Know-how"

IN MOLDING POLYETHYLENE FOR ELECTRICAL INSULATION

Dillon-Beck has successfully pioneered the molding possibilities of POLYETHYLENE, which affords such remarkable adaptability as an electrical insulator. From our experience in molding this new thermoplastic for critical radar connectors, we recommend it as an ideal plastic for such items as rigid connectors requiring high resistance to extreme temperatures. Inquiries invited on the technical properties of molded polyethylene for essential war work.

DILLON-BECK MFG. CO.

ENGINEERS • DESIGNERS • MOLDERS

285 SO. 21st ST. IRVINGTON, N. J.

Mark Plastics

IN GOLD, SILVER OR COLORS

Small Designs, Trade Marks, Names, etc.
Clean-cut precision markings on plastic parts at production speeds up to 1,000 per hour, using unskilled operators. Send samples and details of your stamping problems.
Kingsley GOLD STAMPING MACHINE CO.
★ HOLLYWOOD, CALIFORNIA ★

A SPECIALIZED PLASTIC

CIBANITE

FOR ELECTRICAL AND INDUSTRIAL USES

HIGH TENSILE STRENGTH
HIGH DIELECTRIC VALUE

Of especial interest for the molding of electrical appliances, insulators, knobs, panels, sockets, etc.

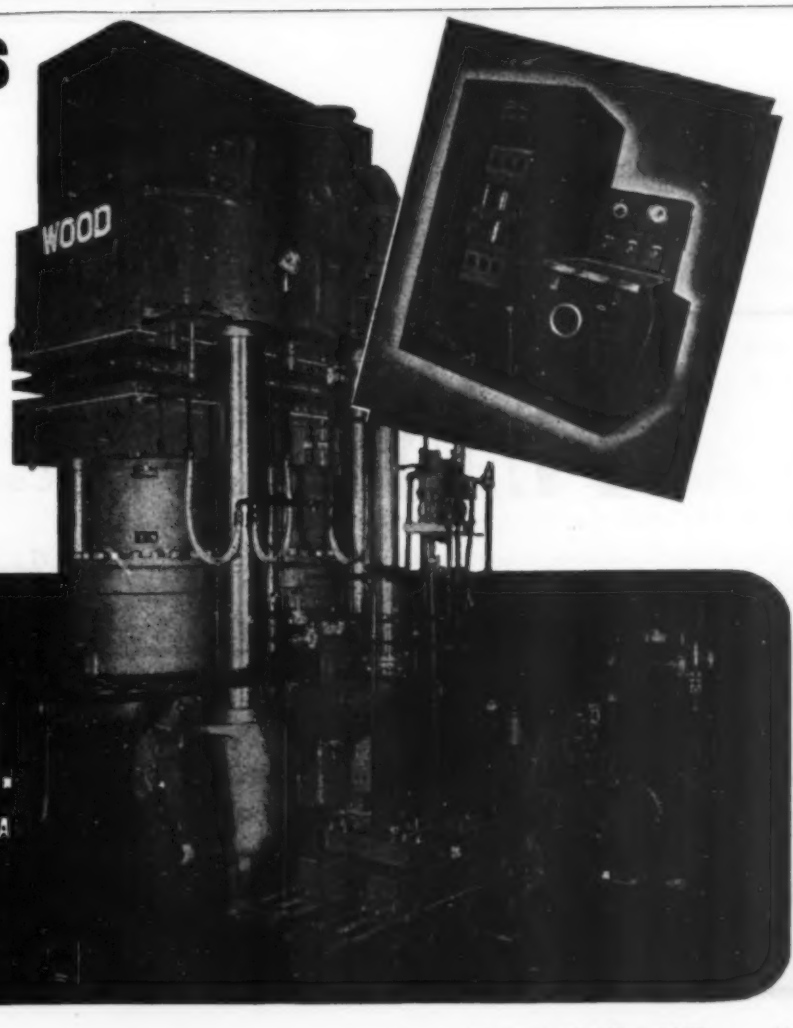
Attractive Natural Color, Golden Brown 50% — Increase in All Strength Factors—Obtained in Laminated and Filled Forms

CIBA PRODUCTS CORPORATION, 77 RIVER ST., HOBOKEN, N. J.

HYDRAULIC PRESSES FOR EVERY NEED...

From small laboratory presses to massive production units, the R. D. Wood Company designs and builds hydraulic presses to meet every requirement. Typical of variety are the 570-ton Laboratory Press with electrically heated platens shown in inset, and the 3450-ton Hard Board Press with steam heated platens.

The Wood engineering department stands ready at all times for consultation on your hydraulic press problems.



R. D. WOOD CO.

PHILADELPHIA · PENNSYLVANIA

HYDRAULIC PRESSES FOR EVERY PURPOSE

thermoplastics scrap BOUGHT

reconditioned molding powder SOLD

SELL US YOUR THERMOPLASTIC WASTE. Sell us rejected molded pieces or obsolete molding powders—cellulose acetate, cellulose aceto-butyrate, polystyrene, methyl methacrylate, or polyvinyl resin.

WE SEPARATE ALL CONTAMINATIONS, removing steel or other mixtures—metal or anything else—and rework and plasticize the material into first class, ready-to-use reprocessed molding powder.

BUY FROM US when reconditioned molding powder is needed for your process. You'll find our product a trustworthy and reliable element. Contact us at our modern plant. Inquiries will receive prompt attention.

A. BAMBERGER
plastic
materials

Call or Write
Department M.
44 Hewes St., Brooklyn 11, N. Y.
Evergreen 7-3887
Cable: Chemprod

LAKONE PLASTICS

BY *Compression:* All types of Thermosetting materials, Bakelite, Resinox, Durez.

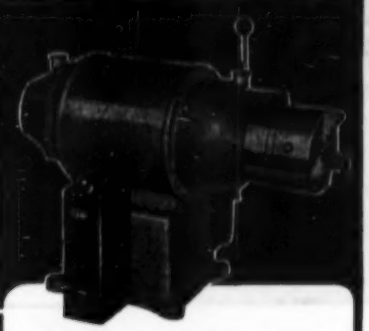
BY *Injection:* Styrene, Cellulose, Acetate, Butyrate, Polythene, Ethocel, Tenite, etc.

MOLDING INSERTS: Takes plenty of specialized experience. Lakone will mold around the most intricate insert and do a clean, sweet job. Orders accepted NOW for large runs of small parts . . . Complete service from top-quality molds to finished parts. Delivery on time! Send B/P for estimate. Ask for samples.

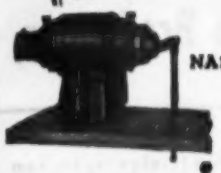
The Lakone Company
500 RATHBONE AVENUE, AURORA, ILLINOIS

IDEAL SPEED LATHES

For accurate, uniform, speedy finishing of metal & plastic parts.



AWARDED October '43



NA1E

NA1C

VA1B

POLISH • LAP • DE-BURR • FINISH

Get posted on this speedier, better way of polishing and finishing plastic bowls, discs, wheels, gears, pulleys, round stock, and other plastic pieces.

Write for Catalog 440. State your finishing problem. Let us help you solve it with a Speed Lathe adapted to your individual needs.

SCHAUER MACHINE COMPANY

ORIGINATORS OF TODAY'S SPEED LATHES

2065 READING ROAD ····· CINCINNATI 2, OHIO

ACCURATE TEMPERATURE CONTROL with WATLOW HOT PLATES

Especially designed for accurately controlled preheating or for "workhorse" heating closely controlled for assembly operations.

Rectangular shapes are available in almost any size, also portable units, wattages to supply up to 850° F.

Heating surface is highly polished, non-warping, cold rolled steel—with no plating to flake off. (Round type, gray cast iron plate.)

Full details in Watlow Catalog—send for it.

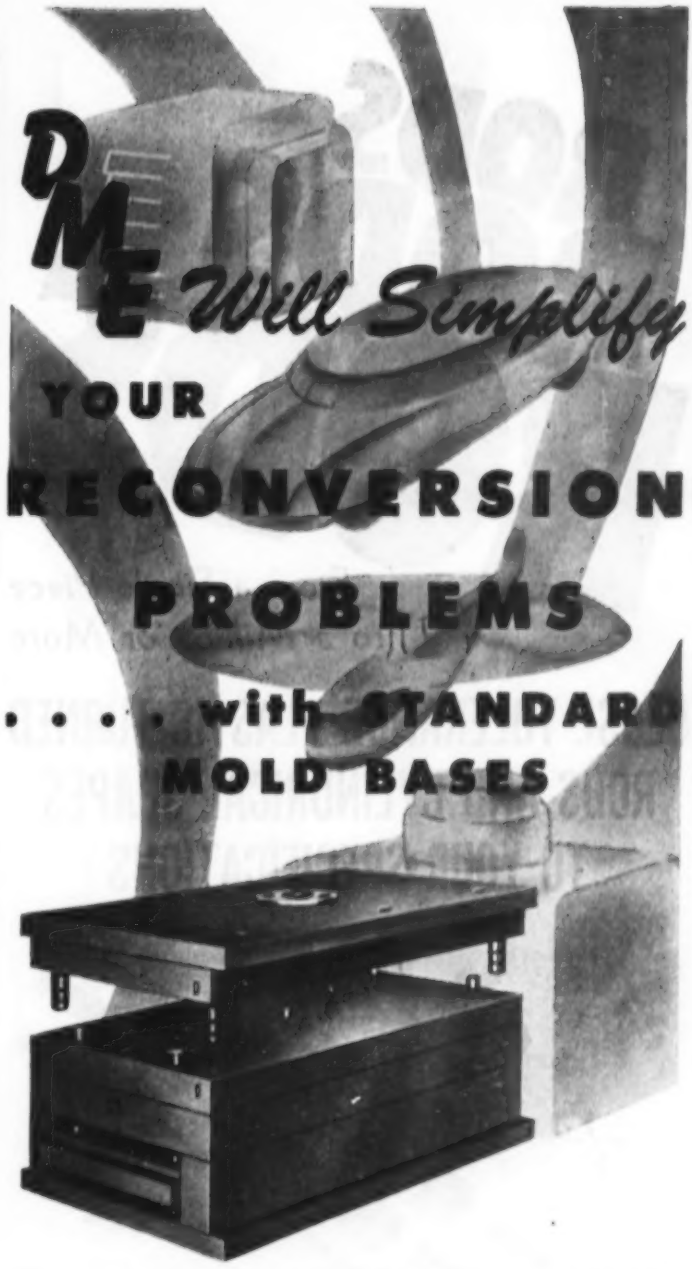
Controls: For temperatures up to 550° F, adjustable clamp-on bi-metallic, or bulb type thermostat is furnished. For temperatures over 550° F, 3-heat snap switch is supplied. Heating element: Burn-out resistant, replaceable Watlow Strip Units. Leveling legs supplied when specified.

SPECIALISTS IN ELECTRIC HEATING UNITS

WATLOW

ELECTRIC MANUFACTURING COMPANY

1328 N. 23d St. St. Louis 6, Mo.



Speed will count greatly in reconversion! You can save valuable machine and man-hours, get into production faster, through the use of DME standard mold bases which enable you to build *THREE* complete molds in the time it now takes to build two. This represents a 33⅓% SAVINGS IN TIME!

In the greatly expanded DME line are 176 different mold base combinations and sizes—standard mold bases, stripper plate mold bases, standard mold base parts—to meet practically every requirement of the mold-maker. All are immediately available from stock.

DME can help you solve your postwar plastic molding problems—why not have us give you full information today?

DME NEWS will be mailed you monthly upon your request.

DME

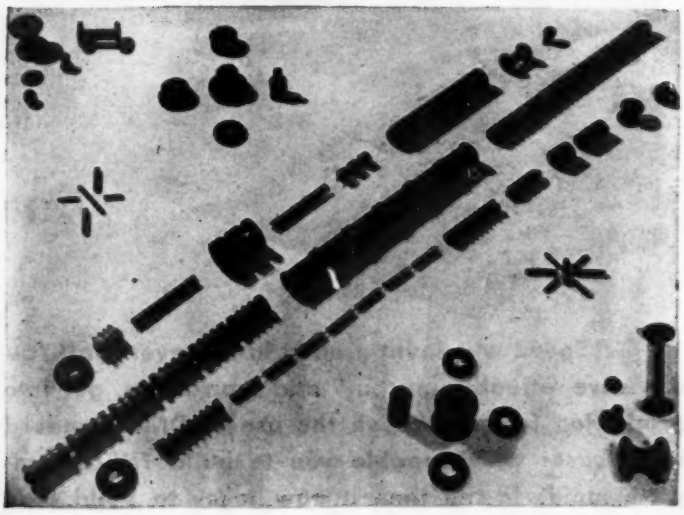
DETROIT MOLD ENGINEERING COMPANY

6686 E. McNICHOLS RD. · DETROIT 12, MICHIGAN

RODS RODS RODS

From a Single Piece to a Million or More

CLOSE TOLERANCE PLASTIC TURNED RODS AND CYLINDRICAL SHAPES TO YOUR SPECIFICATIONS



The Teckna Company is one of the outstanding fabricators of plastic cylindrical shapes and rods, ground to close tolerance, often to plus or minus .0005.

Exclusive patented machinery for close tolerance grinding of Rods—capable of turning out over 50,000 ft. per day.

Your inquiries will receive prompt and thorough attention. Write for special Booklet P outlining the complete scope of Teckna's specialized service.

TECKNA COMPANY
Fabricators of Plastics
Northern Blvd. & 223rd Street, Bayside, L. I., New York
Phone: BAyside 9-5302

Oakite Answers to Plastic Production Problems!

Specialized Oakite Cleaning Helps Speed Up Plastics Production

Where the removal of oil, grease, or other foreign matter from plastics is essential after forming, molding or other fabricating operations, a wide range of specially designed, safe Oakite materials is available to expedite your cleaning.

When using these Oakite materials, you also get all the benefits of our 36 years' successful experience in effectively helping thousands of plants solve their cleaning problems . . . problems that relate to many different production requirements and plant maintenance needs.

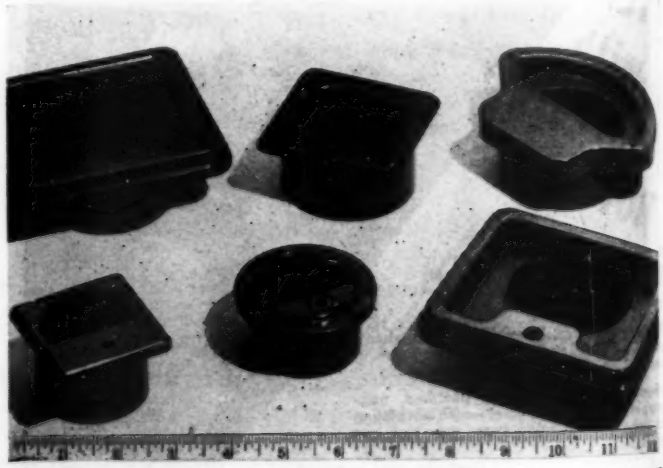
Conveniently located near you is an Oakite Technical Service Representative whose competent, personal help is yours, free for the asking, to assist you in finding the right answers to your cleaning problems. Inquiries invited, promptly answered.

OAKITE PRODUCTS, INC., 46D Thames St., NEW YORK 6, N. Y.
Technical Service Representatives in All Principal Cities of the United States and Canada

OAKITE *Buy Bonds for Victory* **CLEANING**

SKILLED AND TOOLED FOR PRECISION MOLDING

Instrument Cases . . .



Custom Molded Plastics engineered by Midwest, consistently measure up to exacting specifications and requirements. Address your inquiries to MMM, confident that you are consulting an organization skilled and experienced in precision techniques for the production of plastics.

Midwest Molding AND MANUFACTURING COMPANY
331 NORTH WHIPPLE STREET • CHICAGO 12

Flexible in that it doesn't have to cope with the limitations of former methods.

The WINNER Process of manufacturing low pressure laminate products is NEW and DIFFERENT. Through its use, we can maintain exact temperatures while varying pressures from 10 to well over 100 lbs. psi.

Regardless of the fact that some sections of a product contain twice the number of material layers as other sections, ALL are perfectly cured. Our pressure control makes this possible.

Consult us regarding products of any shape or size. Our engineers will be pleased to discuss your problems with you.

PLASTICS **WINNER PLASTICS**

DIVISION OF WINNER MFG. CO., INC.
200 Railroad Ave. West Trenton, N. J.

The Telephone is Born . . .

When Alexander Graham Bell uttered the immortal words, "Watson, come here, I want you", the telephone became a reality. That was in 1876, the same year the Auburn Button Works was founded.

Auburn's skill and reputation as a custom molder have grown steadily over those 70 years. Today, the Auburn mold mark is accepted as a virtual guarantee of a perfect molded part.

•

For small parts molded automatically at low cost, write: Woodruff Company Division, Auburn Button Works, Auburn, N. Y.

Molded by Auburn

MOLD AB MARK

AUBURN ENGINEERED PLASTICS

All Types of Molding — Complete Mold Shop
Extruded Tubes and Shapes

AUBURN BUTTON WORKS
INCORPORATED

MOLDERS SINCE 1876 AUBURN, NEW YORK

INJECTION MOLDING OF ALL THERMOPLASTIC MATERIALS

CUSTOM MOLDED thermoplastic parts is our forte. We have had a wealth of experience in this field both during the war and before. If your future needs include plastic parts, may we suggest that you get in touch with us now?

★ ★ ★

Buy
WAR BONDS AND STAMPS

★ ★ ★

ARMY E NAVY

SPI SOCIETY OF THE PLASTICS INDUSTRY

Franklin

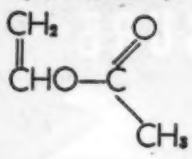
FRANKLIN PLASTICS DIVISION
Robinson Industries, Inc. - - FRANKLIN, PA.

Now Available Without Restrictions

UNPOLYMERIZED

VINYL ACETATE

(STABILIZED)



Purity 99.5% Boiling Range 71.8° to 73°C.

Vinyl Acetate can be polymerized to form resins with exceptional bonding qualities for wood, glass, metal and fibre

Containers:—

410 lb. drums; 62,500 lb. tank cars

For further information write to:

NIACET

CHEMICALS CORPORATION

4740 Pine Avenue • Niagara Falls, N. Y.

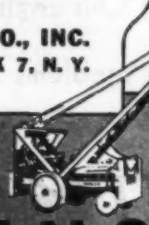
Materials

PROCESSING EQUIPMENT

Sifters, Crushers, Cutters, Dry and Liquid Mixers, Mills, Grinders, Pulverizers, Conveyor Systems, Complete Installations.

The handling equipment construction "know-how" of the Mercer Engineering Works, Inc., Clifton, N. J. . . . The more than 40 years processing equipment experience of Robinson Mfg. Co., Muncy, Pa. . . . All are embodied in and represented by

MERCER-ROBINSON, CO., INC.
30 CHURCH ST., NEW YORK 7, N. Y.



Materials

HANDLING EQUIPMENT

Trailer Trucks (All Types) Wheel Tractor Cranes (3 to 7 ton) Fork Lift Trucks, Lift Platforms, Hoists, Live Skids, Wheels, Casters.

INSULATION IS THE ANSWER TO ELECTRICITY

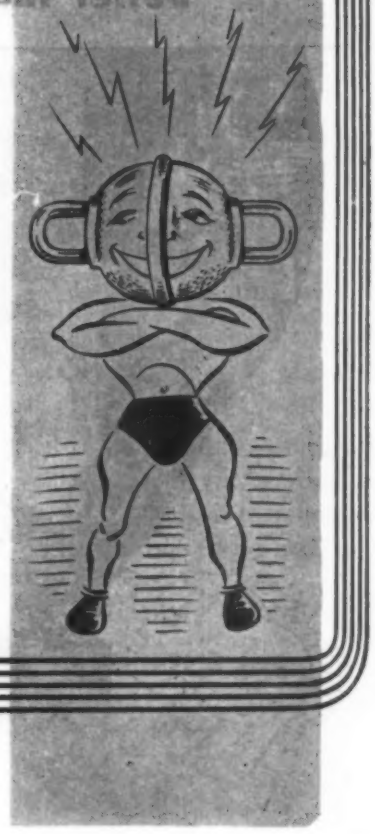
Wherever you find electricity, you find insulation. And wherever you find insulation, you find a use for one of our stock or custom made products.

We mold plastics, primarily for insulation purposes, for the largest users — Power Companies, Radio Stations, Telephone and Telegraph Companies.

Our specialization in the dielectric properties of plastic materials has led us into the creation of a number of stock items, the formulation of some of our own special materials and a general background of "know-how" applicable to your specialized insulation problems.

We are custom molders of all plastics.

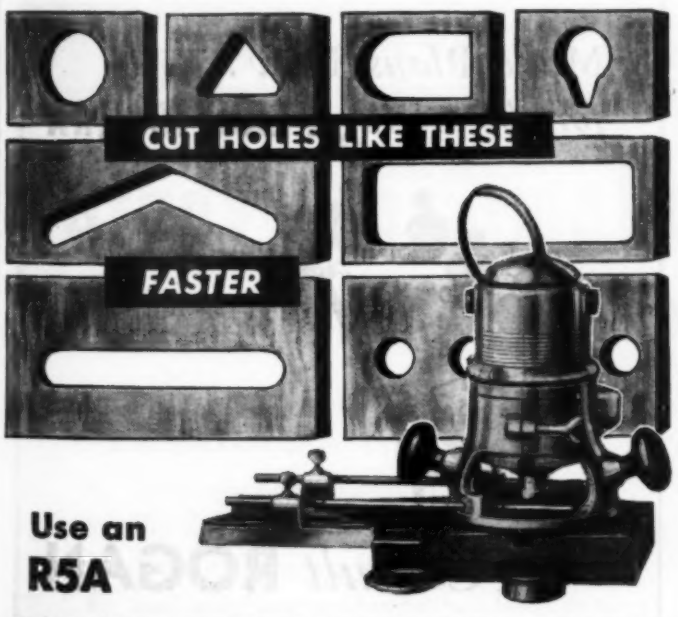
Call or write our engineers.



INSULATION MANUFACTURING CO.

CUSTOM MOLDERS OF PLASTICS FOR INDUSTRY

11 New York Avenue — Brooklyn 16, N. Y.



Use an **R5A**

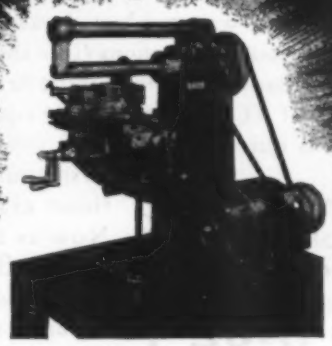
STANLEY - CARTER PORTABLE ROUTER

Routing odd-shaped holes and trimming any outside contours are easy jobs with the R5A Router. It's just the tool you need to speed work on new models or samples, and on parts made from plastic sheets, etc. A few simple attachments extend its use to hundreds of operations.

Motor unit is 1 H.P., 18,000 R.P.M. – permits smooth clean cutting. Complete details on request. STANLEY ELECTRIC TOOLS, DEPT. C, New Britain, Connecticut.

CARTER (STANLEY) TOOLS

ONE BENCH MACHINE FOR BOTH HORIZONTAL and VERTICAL Milling



benchmaster mill with horizontal spindle and overarm

FOR PRECISION TOOL WORK OR HIGH-SPEED PRODUCTION

benchmaster — offers a bench milling machine easily convertible from a conventional horizontal to a vertical miller by simply interchanging the spindle attachments.

ACCURATE • VERSATILE • LOW PRICED

SPECIFICATIONS: Table size–6" x 14"–Three Tee slots ⅜", 2" center • Longitudinal travel 8½" • Traverse travel 5½" • Vertical travel 8½" on vertical mill – 9½" horizontal mill • Height 28" • Weight (less motor) 215 lbs. • Requires ⅓ h.p. motor • Spindle speeds (standard 1725 rpm motor) 450-850-1400-2100 rpm.

benchmaster tools — manufacturing company

2952 w. pico, los angeles 6, cal.

are **7** heads better than **1**?

VICTORY'S* Engineering Staff and 6 Consulting Engineers work together . . . to give you BETTER MOLDED PLASTICS!

If your post-war product demands injection molding to closest tolerances (like those required in the work we are now doing for the Armed Forces), you'll find VICTORY* completely equipped to do a better job quickly, and at the lowest possible cost consistent with finest craftsmanship. Now is the time to plan with our engineers and their consultants, so that your problems can be solved *before* you are ready to market your product.

AUTOMATIC INJECTION MOLDING

Small and large parts

UP TO 17-OZ. SHOTS

Lumarith, Tenite, Fibestos, Plastacelle, Crystallite, Lucite, Ethyl Cellulose, Polystrene, Lustron, Styron, Cellulose Acetate and others . . . all molded to your exacting specifications.

Member: Society of the Plastics Industry

*VICTORY MANUFACTURING COMPANY
1722 W. Arcade Place, Chicago 12, Ill.
ESTABLISHED 1930

INORGANIC PIGMENTS *for plastics*

INSOLUBLE
HEAT AND LIGHT RESISTANT

Let us know the application . . . Color samples supplied on request.

WRITE **B. F. DRAKENFELD & CO., INC.**
45-47 Park Place, New York 7, N. Y.

Drakenfeld

Make Plans Now . . . for the coming **PLASTIC ERA**

Consult ROGAN

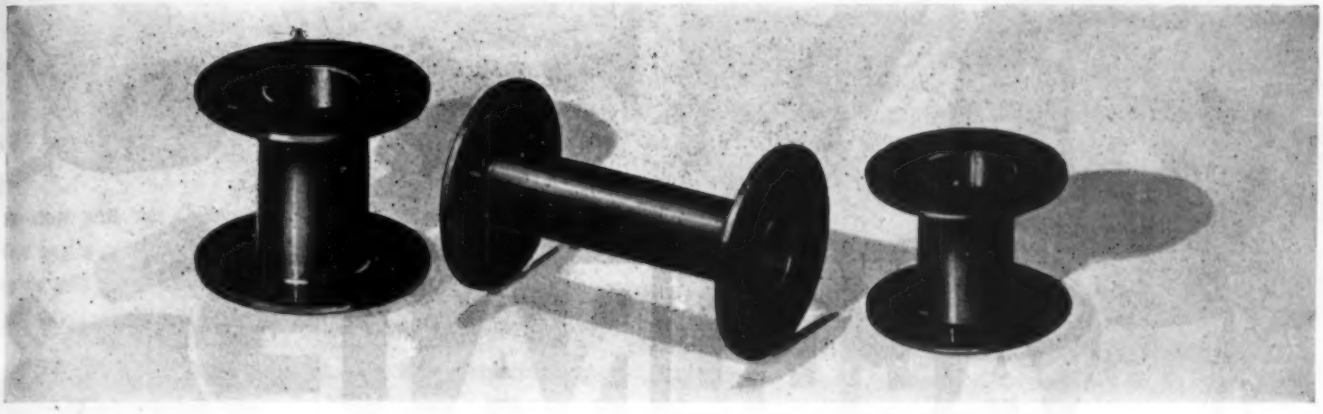
Here at Rogan, seasoned engineers are ready and willing to assist you in determining your post-war *Plastic* requirements.

Whether your peacetime products are to include electronic equipment, electrical appliances, stoves or what have you, the Rogan Organization will gladly provide cost-free advice on all phases of plastic production.

Send Us Your Specifications Today!

ROGAN BROTHERS
Compression Molders and Branders of Plastics
2005 So. Michigan Avenue Chicago, Illinois

Custom Molding Approaching a Fine Art!



Made to a special order, delicate, accurate to the last degree, these bobbins for use in power relays illustrate the type of molding done as a matter of course by K. & J. Thousands of these pieces were produced by our machines to meet an urgent demand. You, too, can profit by K. & J.'s experience and molding skill.

ESTABLISHED 1919 — TRADE MARK

KUHN & JACOB MOLDING & TOOL CO.

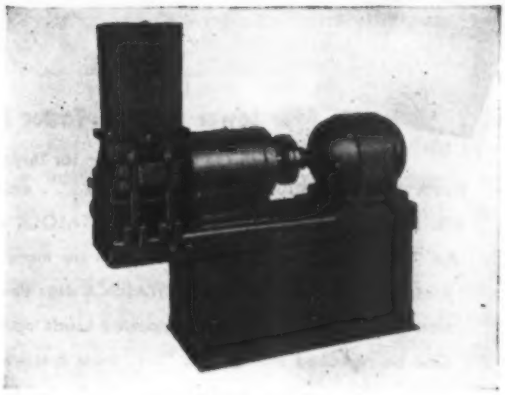
1200 SOUTHARD STREET, TRENTON 8, N. J.
TELEPHONE TRENTON 5391

Plastic Molding

Sales Representatives: NEW YORK—S. C. Ullmann, 56 W. 42nd St. PHILADELPHIA—Towle & Son Co., 18 W. Chelton Ave. Bldg.
NEW ENGLAND—Wm. T. Wyler, 204 Lordship Road, Stratford, Conn.

Cumberland Scrap Grinders

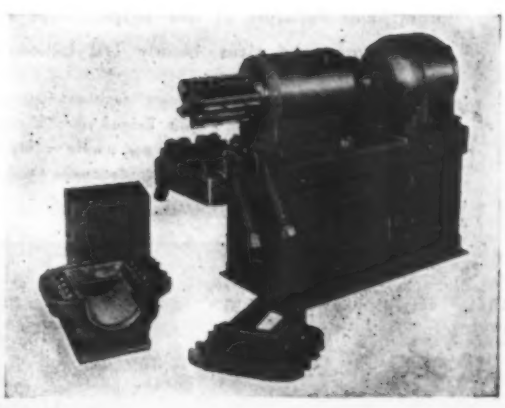
Study the Simplicity of this Post-war Model!



DESIGNED specifically for granulating plastic scrap, our machines have the following advantages:

1. Extremely rugged construction.
2. Quick to dismantle.
3. Super-easy to clean for color changes.
4. Stall-proof cutting chamber runs full, cuts more.
5. Two models have added side feed slot to take continuously extruded strips.

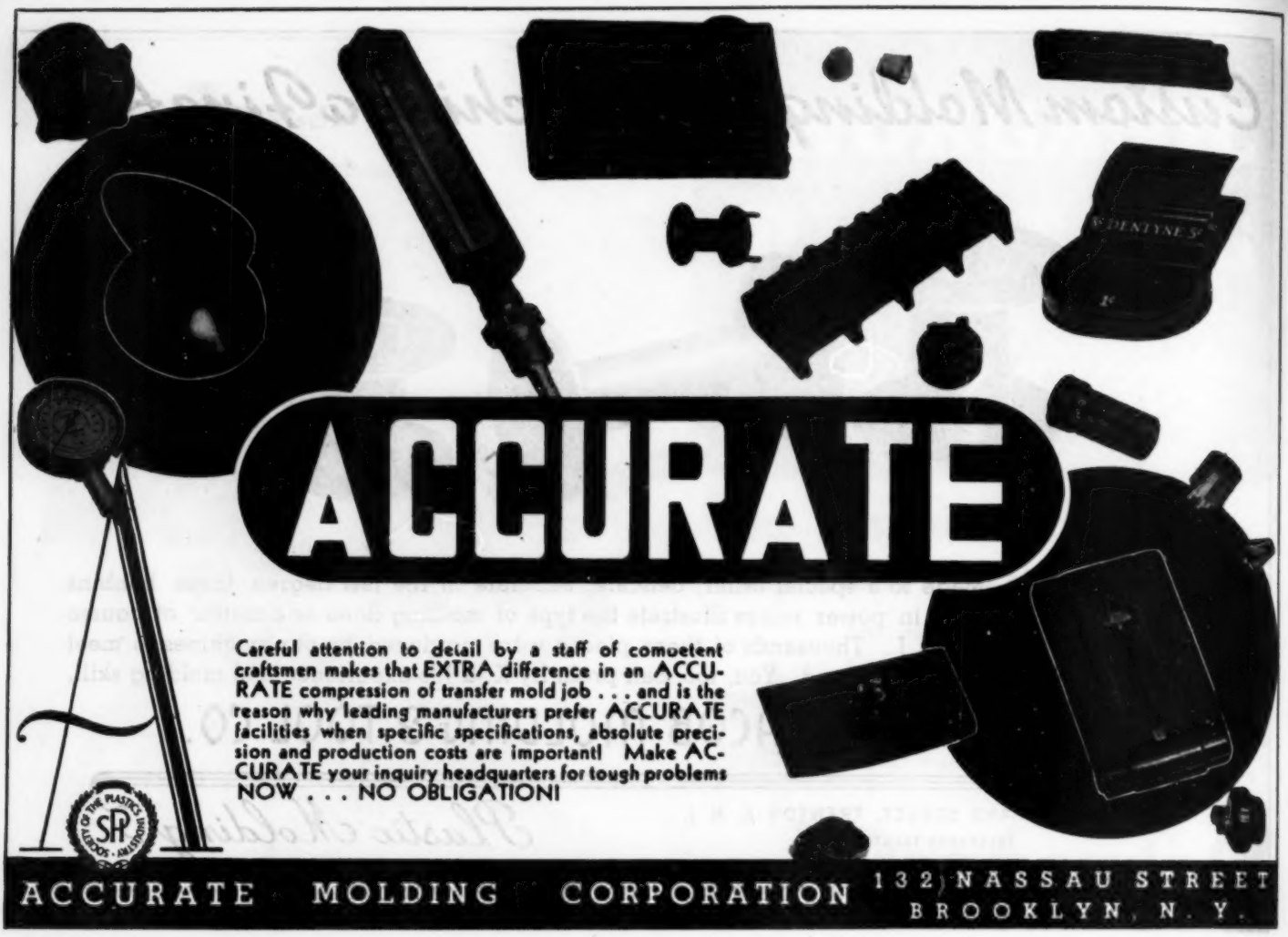
Our four models span all normal requirements. # 1½, Machine Illustrated



Prompt deliveries. Request "Grinder Data."

CUMBERLAND ENGINEERING CO.

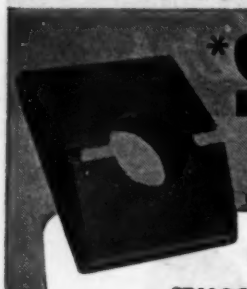
Dept. A, Box 216, Providence, R. I.



ACCURATE

Careful attention to detail by a staff of competent craftsmen makes that EXTRA difference in an ACCURATE compression or transfer mold job . . . and is the reason why leading manufacturers prefer ACCURATE facilities when specific specifications, absolute precision and production costs are important! Make ACCURATE your inquiry headquarters for tough problems NOW . . . NO OBLIGATION!

ACCURATE MOLDING CORPORATION 132 NASSAU STREET BROOKLYN, N. Y.



*STALOCK "PUSH-ONS"

PATENT PENDING

For Lower Costs . . . Faster Assemblies

STALOCK *Push-On* is a fastener for threadless studs, rivets . . . even nails. Locks with a push . . . unlocks with a lift. Plastics and metals fastened with STALOCK stay locked. An "all around" bite is achieved with no more than finger pressure. As tension increases, STALOCK digs deeper. In tension tests a 3/16" stud has supported loads up to 1800 lbs. Can be removed with only a "lift" from a screwdriver. Fast action plus positive performance. Made by ADEL, world's largest manufacturers of line support clips and blocks. 13,000 types and sizes. Nearly 1/3 billion in service.

STALOCK nut "all around fasteners" for sheet metal screws surpass standards of AAF Spec. No. 25533. Exceed vibration requirements by 400%. Saddle, anchor and flat types and a wide variety of other types and sizes. For specifications and technical data write Dept. N-2101

* TRADE MARK

ADEL Precision Products Corp.
Burbank, Calif. • Huntington, W. Va.
OFFICES: SEATTLE 1, DAYTON 2, DETROIT 2, HAGERSTOWN, BALTIMORE 1, NEW YORK 20
CANADA: RT. S POWER ENGINEERING CORP.

ADEL TRADE MARK

— DEFINITELY IN TOMORROW'S PLASTIC PICTURE!

With 25 years of "plastic yesterdays" behind him, Larry Cook offers you a solidly established plastic background for that brilliant future plastics will mold for you.

Now L. H. Cook, Inc., is operating at top capacity — but there's plenty of planning room, so let Larry Cook know what plastic problems your future will include. There's no obligation.

LAWRENCE H. COOK, INC.
MANUFACTURERS OF PLASTIC MOLDS & TOOLS
65 MASSASOIT AVE., EAST PROVIDENCE 14, R. I.

NOW IS THE TIME

to start post war planning and working on plastic molded parts Our engineers will be glad to call and discuss any problem having to do with compression or transfer molded parts.

RADIO CABINETS all sizes and other large housings are our specialty

All our molds are made by men with more than thirty years experience. Our engineers offer a similar background of experience. Combined, they guarantee production of highest quality, good looking moldings on the highest possible production basis.

CONSULTATION with our engineers is yours for the asking.

Plastimold, TRADE MARK INC.
ATTLEBORO, MASS.

SERVING Cosmetic, Drug Trade and Other Industries

Fabricators of
PLASTIC FILMS
VINYLITE, BUTRYAL
CELLULOSE ACETATE
for
Wearing Apparel, Sporting Goods and Household Items

Laminators of
ALL TYPES
PLASTICS
VINYLITE, BUTRYAL
CELLULOSE ACETATE

Fabricators of
• BOXES
• CANNISTERS
in all forms and shapes for packaging purposes.

National
TRANSPARENT PLASTICS CO.
1897 COLUMBUS AVE. • SPRINGFIELD 3, MASS.

AMERICA'S 2nd LARGEST CATTLE RANCH IS IN
Hawaii
and so is one of her liveliest markets!

WEARER STOY

TO MANUFACTURERS—This Hawaiian cowboy, singing of his islands, is singing of a $400,000,000 market for your goods. Retail sales in Hawaii topped that figure last year.

Hawaii has a population of more than half a million. They have year-round payrolls. They pay more in income tax than 14 of the states. They're building an enormous spending reserve with a bond-buying record that leads the nation. And they'll buy virtually everything the mainland has to sell!

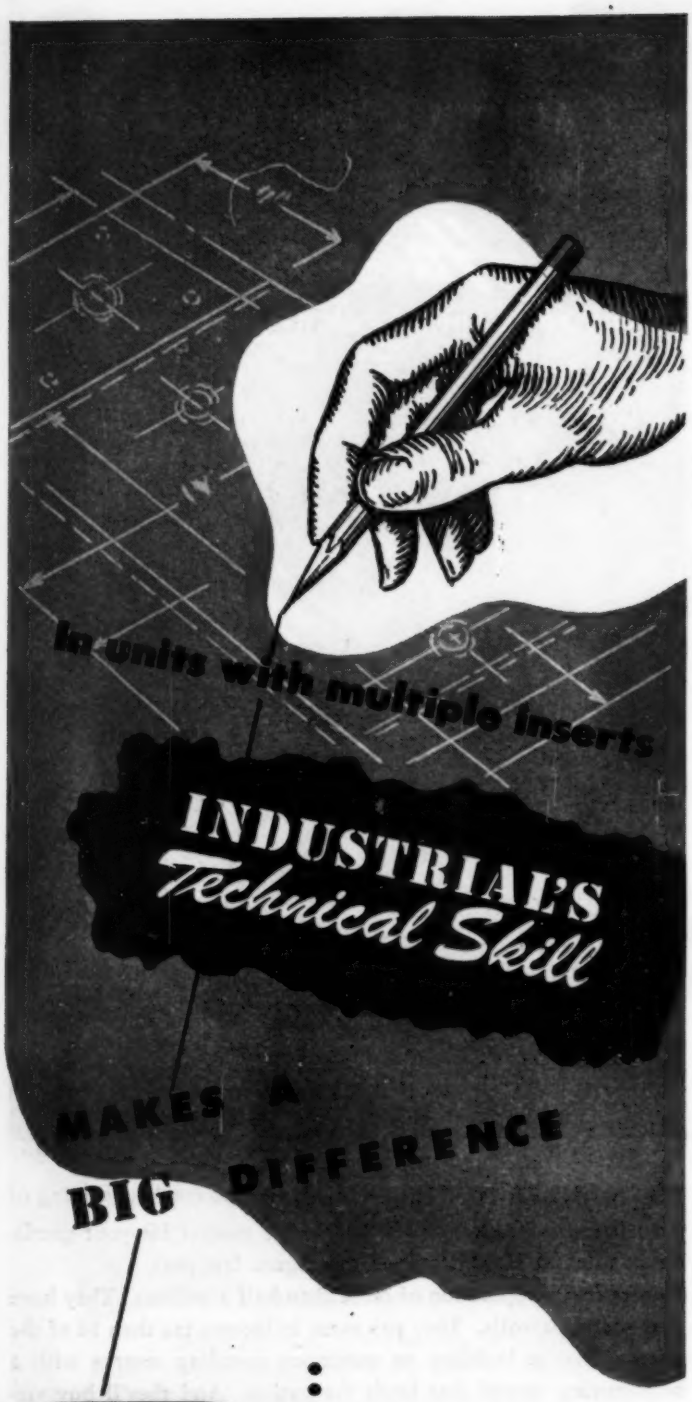
Here is a prime, postwar market you ought to be exploring right now—through R. A. Howe & Co. You'll be represented by a young, aggressive, well-financed company that is handling some of the country's most active lines—and doing an outstanding job.

We have ample warehousing in Honolulu, and make freight deliveries to outlying islands *by air.* We've a hard-hitting staff composed of men from various racial groups. They know Hawaii. And they know the Far East. They'll be out there strong after the war—opening up the markets of the Orient for your lines.

If your postwar expansion is westward bound, write us. Let us tell you the kind of job we can do for you in the Pacific.

R.A.HOWE & CO. DISTRIBUTORS AND REPRESENTATIVES *Hawaii*

816 FORT STREET • HONOLULU, HAWAII • U. S. A.



Production "Know How" solves the manifold little technical problems of units with a number of inserts. It assures, in mass production, a high standard of uniformity. If you have a parallel problem, won't you write us?

INDUSTRIAL MOLDED PRODUCTS CO.

2035 W. Charleston Street — Chicago 47, Illinois

NUMBERALL

NUMBERING MACHINE FOR HOT STAMPING MODEL 270

Model 270

Model 270 Numbering Machine is for hot stamping on plastic, wood, etc. Any number of wheels can be furnished with various size characters. An electric heating element is furnished with the machine. Can be furnished with a rheostat for controlling temperature. May be used in any hand, foot, or power press.

•

Model 223P is available with any number of steel types and in various size characters. An electric heating element is furnished and a rheostat for controlling heat is available. Can be used with color foil. May be used in any hand, foot, or power press.

Write for Bulletin MP270

NUMBERALL STAMP & TOOL CO.
HUGUENOT PARK STATEN ISLAND 12, N. Y.

EXTRUDED PLASTIC TAPE

FOR CONTINUOUS PUNCH PRESS FEEDING

Acetate, Acetate Butyrate, Ethyl Cellulose, Vinyls, Styrenes

For any type of punch press operation, NATIONAL can supply continuous strip stock, made to accurate dimensions, suitable for washers, gaskets and shapes of any kind, or for such purposes as forming, blowing, beading and general fabrication. Furnished in thicknesses up to ⅛-inch and widths up to 6 inches.

NATIONAL PLASTIC PRODUCTS Company

ODENTON, MD.

RELAX!

You'll Get The Answer To That Molding Problem If You Consult

MARTINDELL

Your troubles will vanish like smoke if you will take advantage of the knowledge and skill of an organization that knows molding from design to finished piece. Your post-war plans can be laid now, without in any way detracting from the war effort. But choose a molder whose experience embraces materials, methods and markets—and your choice will be MARTINDELL MOLDING CO.

Till the curtain goes down in the Pacific theatre, we're still 100% on war orders. But we'd be glad to discuss future business NOW.

MARTINDELL MOLDING CO.

OLDEN and 6th Street • TRENTON, NEW JERSEY

MOLDS

INJECTION

Submit your problems to our experienced engineering staff, equipped to handle your most intricate mold problems.

We design and build automatic molds for many leading molders. Why not let us solve your problems? Our molds are tested before shipping, on our new 16 oz. Lester injection molding machine. 1911 • 1945

STANDARD TOOL CO.

75 WATER STREET

LEOMINSTER, MASS.

N. E. Sales representatives for—
Lester Injection Molding Machines
Ball & Jewell Grinders

ORGANIC PEROXIDES

CATALYSTS FOR POLYMERIZATIONS DRYING ACCELERATORS · OXIDATION AGENTS · BLEACHING AGENTS

LUCIDOL*
(BENZOYL PEROXIDE)

LUPERCO*
(PEROXIDE COMPOUNDS)

ALPEROX* C
(TECHNICAL LAUROYL PEROXIDE)

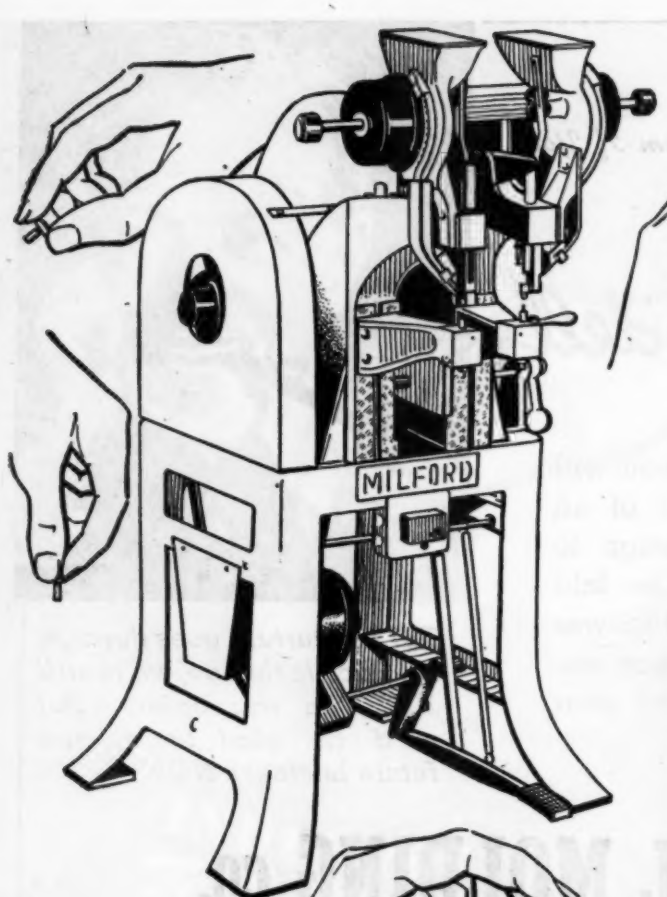
LUPEROX*
(PEROXIDE PASTES)

Special Organic Peroxides

* REGISTERED TRADEMARK

LUCIDOL CORPORATION

BUFFALO (5) N. Y.



ONE for ALL

The old-fashioned method of putting each rivet into each hole with fingers instead of with MILFORD automatic machines, is costly and unnecessary. For rivet speed in your assembly line, call or write. We will be glad to give you details.

The MILFORD RIVET & MACHINE CO.

EASTERN DIVISION — CENTRAL DIVISION
MILFORD, CONN. ★ ELYRIA, OHIO.

Automatic Button Finisher-

ELIMINATES MANPOWER PROBLEMS

THIS compact automatic machine punches fins and cleans holes of Urea, Phenol and Melamine buttons. Completely automatic it saves countless man-hours of work and performs with perfect efficiency. Can be set & re-set to handle all sizes. 3 models: Model S accepts sizes 12 to 34; Model SP accepts sizes 36 to 50; Model SX accepts sizes 12 to 50. Production up to 450 per minute.

ButtOndeX

CORPORATION
386 FOURTH AVENUE NEW YORK, N. Y.

"C.A."

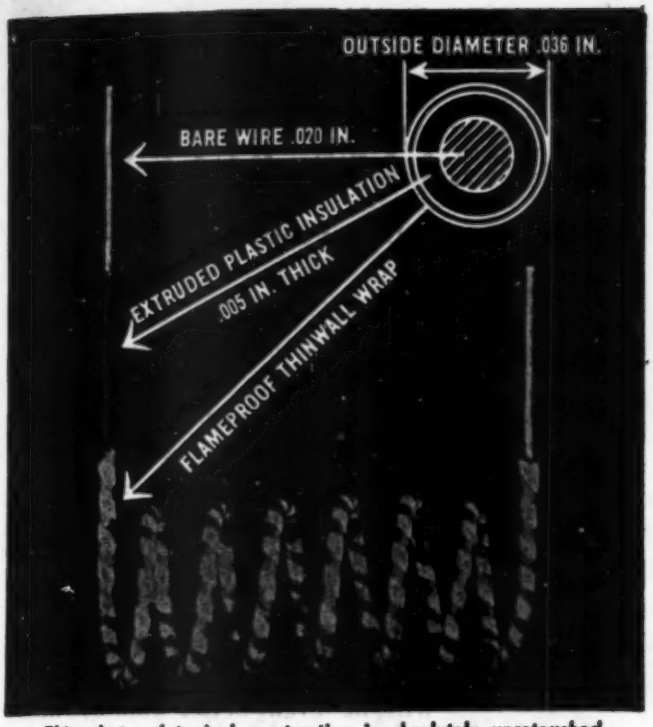
"C.A." Grade pearl essence, specially developed for use with Cellulose Acetate moulding powder.

NON - YELLOWING

•

MEARLMAID PEARL ESSENCE

THE MEARL CORPORATION
153 Waverly Place New York, N.Y.



This photo of typical construction is absolutely unretouched

Voltage Breakdown — 7000 Volts
(For spiraled section shown in photograph after 5 minutes in water)
Insulation Resistance—30 Megs. Per 1000 Ft. at 60°F.
(After 72 hrs. in water)

SURCO-AMERICAN

New

THINWALL WRAP

PLASTIC INSULATED FINE WIRE

UNBELIEVABLY THIN

Surco-American Thinwall Wrap is the first uniformly high quality fine wire, with extruded plastic insulation and flame proofed yarn serving, available to industry. Surco-American Thinwall Wrap is characterized by:

- **High dielectric properties**
- **Maximum saving in space and weight**
- **Unlimited coding and identification**
- **High temperature operation**
- **Excellent abrasion resistance and toughness**
- **Maximum protection against damage by soldering iron**
- **Unusual flexibility at below freezing temperatures**
- **Flameproof qualities**
- **Good end and spot-stripping characteristics**
- **Low cost**

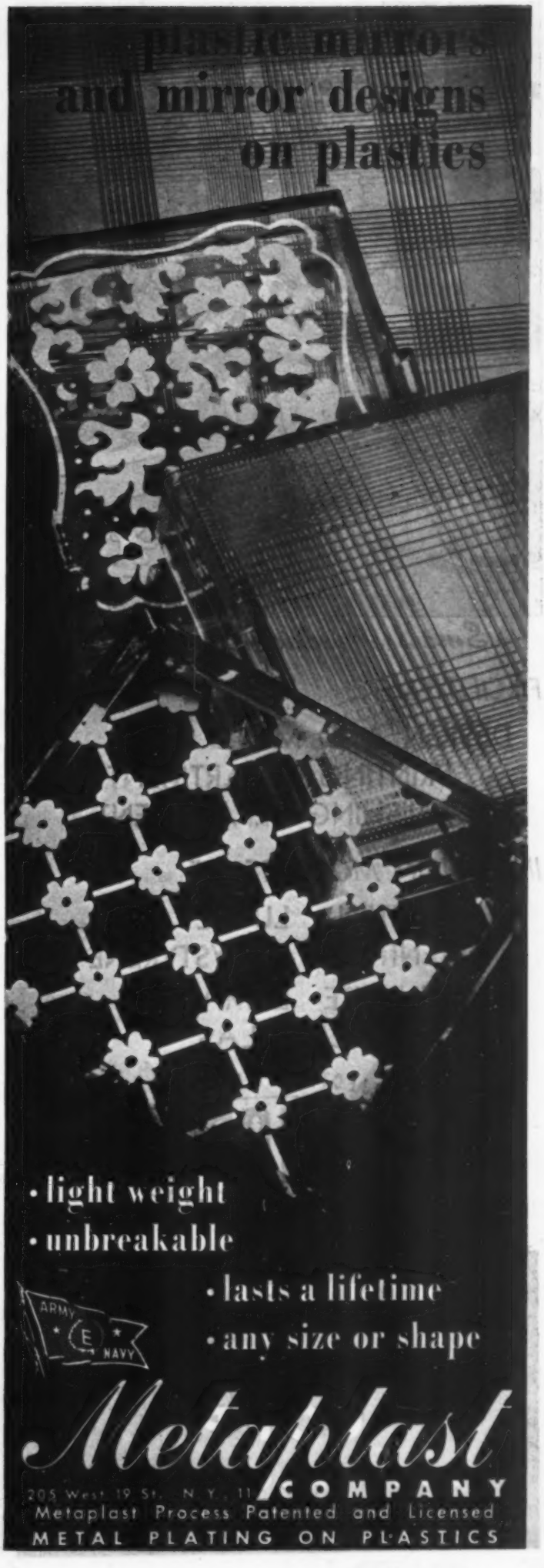
Surco-American Thinwall Wrap is available in a wide variety of formulations, finer sizes of wire and thinner insulations than shown above, for use where maximum performance under specific operating conditions is required.

SURCO PRODUCT

Surprenant

ELECTRICAL INSULATION CO.

Dept. T 84 Purchase St., Boston 10, Mass.



Small Headaches of Today

FACILITIES:

DESIGN AND MOLD SHOP
PRINTING DEPARTMENT
FINISHING DEPARTMENT

INJECTION MOLDERS OF:

TENITE I LUCITE
TENITE II POLYSTYRENE
VINYLITE LUMARITH
PLEXIGLAS

INJECTION MOLDING
MINCOR
YOUR PLASTICS DEPARTMENT

MINNESOTA PLASTICS CORP.
366 WACOUTA ST.
ST. PAUL 1, MINNESOTA

BETTER PULPS for cellulose-base products

In war or in peace, Rayonier's technical efforts are constantly leading to the development of new, improved forms of wood cellulose to benefit mankind. Close collaboration with customers on their individual problems is the guiding influence in all our research and production activities.

That is why Rayonier products are the best today — why they will be even better tomorrow.

RAYONIER
INCORPORATED
122 EAST 42nd STREET, NEW YORK 17, N. Y.

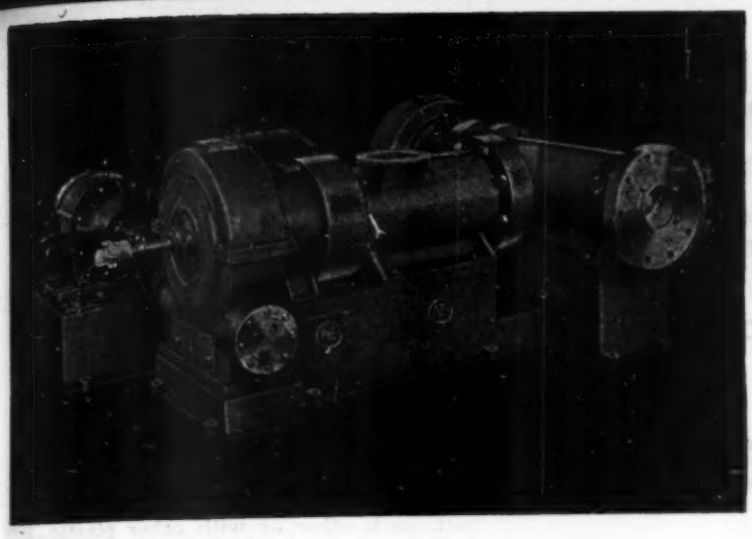
here's how...

HOBBED CAVITY MOLDING

We're in the business of solving tough molding problems through hobbing. Many skeptical manufacturers have been convinced, by actual demonstration, of the economy, speed and accuracy of *hobbed cavity molding.*

If you have a problem, perhaps we can show you . . . "here's how"! Write today, to our engineering department.

NEWARK DIE COMPANY, Inc.
20-24 SCOTT ST NEWARK, N. J.
Telephone — MARKET 2-3772, 2-3773



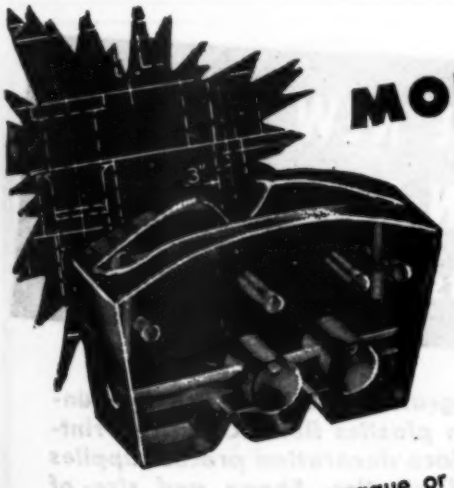
NE DUAL TUBERS

THE comprehensive NE Rubber and Plastics Processing Equipment catalog shows the complete line of NE Tubers and Strainers. Shows cross section views of construction and the many types that can be adapted to meet any grade of material processed. Nearly a half century of specialization in Tuber and Strainer design and manufacture qualify National Erie Corporation as a dependable source of supply. Consult with NE engineers.

10″ NE Special Dual Plasticizing Tuber is used in a special collodian process. Both stock screws are 10″ diameter, worm gear driven. Five zones of controlled heating are provided.

Write for Booklet

NATIONAL ERIE CORPORATION
Erie, Pa. NE *U. S. A.*



MODELS

- for study
- experimentation
- sales promotion

in transparent, opaque or other plastics, metals or wood. Also transparent plastic casings to make working parts visible for demonstration.

MOLDS

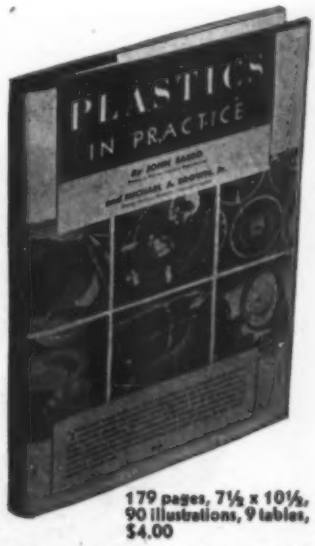
for all types of molding — Compression, Injection and Transfer.

CONDOR ENGINEERING CO.
TOOLMAKERS TO THE PLASTIC INDUSTRY
384 SECOND AVENUE • NEW YORK 10, N. Y.
GRAMERCY 3-2887

Get practical data on
PLASTICS
from these 102 commercial applications

TO go ahead fast in designing, merchandising or developing new products, you want the *facts*—on properties of available plastic materials, on methods of fabrication, on product design, and finally, on cost.

"Will it lower production costs? Will it be a product improvement?" Find the answers to your practical questions on plastic materials and processes in this sound, usable book by two pioneers in plastics.



Just Published!
PLASTICS IN PRACTICE
BY JOHN SASSO
Managing Editor, *Product Engineering*
and M. A. BROWN, JR.
Monsanto Chemical Co.

179 pages, 7⅛ x 10½, 90 illustrations, 9 tables, $4.00

THIS book analyzes for you 102 specific case studies of actual successful commercial products, showing for each the problems encountered, the solution, and why it was adopted. It gives you *proved* data, accurate, understandable, practical, a critical evaluation of every type of plastic and every method of fabrication in use today, with a careful estimate of their possibilities for the future.

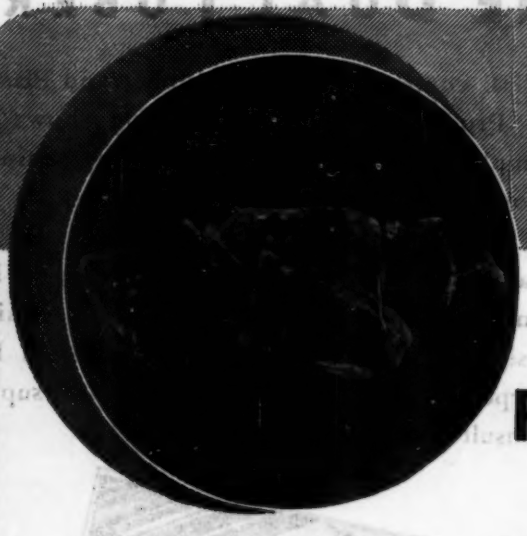
The applications chosen are, without exception, representative of all the fields in which plastics are or may be used—electrical, electronics, radio, building, aircraft, automotive, to mention only a few.

Use this book to
—give you an idea of the relationship of plastics to metals and other materials
—show you whether a proposed material or process will overcome *your* specific problems
—answer your questions of salability and costs, as well as those of specific properties and mechanical considerations

See it 10 days FREE—on approval!

———SEND THIS McGRAW-HILL COUPON———
McGRAW-HILL BOOK CO., Inc.
330 W. 42nd St., New York 18, N. Y.
Send me Sasso and Brown's PLASTICS IN PRACTICE for 10 days' examination, on approval. In 10 days I will send $4.00, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name.....
Address.....
City and State.....
Company.....
Position.....Mod P 7-45
(Books sent on approval in U. S. only)



RESINS and PLASTICIZERS

Produced Under Precision Controls for Exacting Plastics Production . . .

PICCOLASTIC Modified Styrene Resins in a wide range of molecular weights, melting points and solvencies. In combination with each other or with other plastic bodies make possible the creation of results hitherto unattainable .

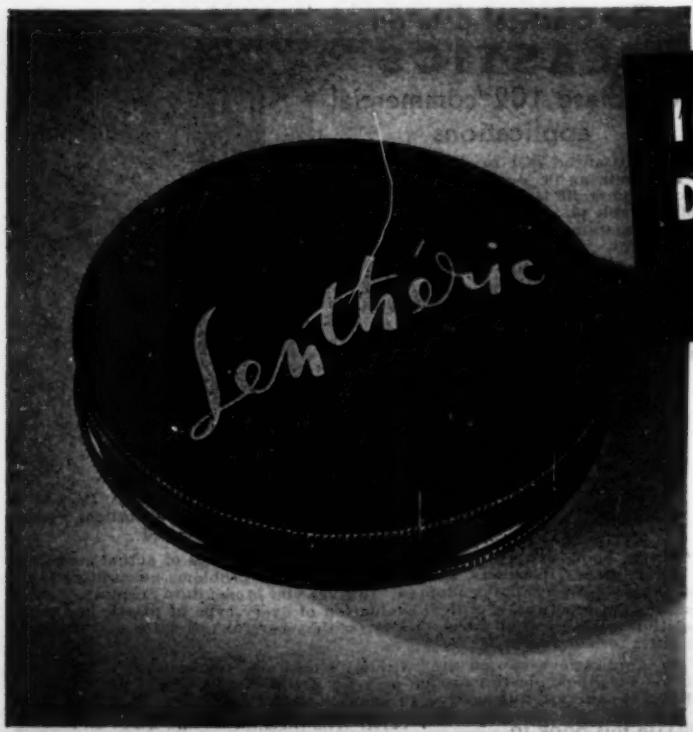
PICCOLYTE . . Hydro-Carbon Terpene Resins chemically inert, acid and alkali resisting, compatible with all rubbers, coal tar residues, pitches, paraffins and waxes. Clear color permanence . . .

PICCOUMARON Para Coumarone Indene Resins. Offered in light and dark color in a wide range of melting points . .

A complete line of Precision plasticizers to meet the requirements of all types of plastics compounding . . . Our laboratory will assist in determining the plasticizer best suited to your compounding problems. Write for complete data

STANDARD Chemical Company

General Offices AKRON 8, OHIO



INVESTIGATE NEW SURFACE DECORATION FOR PLASTICS!

Supplants old methods!

Permanent, Integral! Already in use by hundreds of firms in plastics field. Creative Printmakers new surface decoration process applies all colors to all plastics. Shape and size of molded or fabricated object is no limitation. All decorations applied permanently, bonded chemically with the piece. Used on lipsticks, packages, closures, dials, name plates, advertising premiums and many other items. Guaranteed not to scratch, wash or rub off. Weather resistant. Write for prices and information.

Creative PRINTMAKERS GROUP

14 WEST 17th STREET • NEW YORK, N.Y. • Chelsea 3-6803

Surface Decorators for the Plastics Industry

A fast, practical, scientific

PRE-TEST FOR WEAR RESISTANCE

***The* TABER ABRASER gives "Advance Data" on the Wearability of**

PAINTS · LACQUER · PLATING
LEATHER · RUBBER · PAPER, ETC.

In checking the wearability of your own products as compared with competitors', as well as in research on new developments—the Taber Abraser gives you an accurate rating of resistance to surface abrasion quickly, simply. Eliminates slow, costly performance tests. Used by hundreds of manufacturers and research laboratories. . . . Full particulars on the Taber wear testing procedure will be sent on request. No obligation.

TABER INSTRUMENT CORPORATION
111 MO Goundry Street North Tonawanda, N. Y.

The Taber Test *Proves* What Wears Best!

®

Your prescription for a reliable, capable, experienced molder of Plastics

•

RECTO

MOLDED PRODUCTS INC.

CINCINNATI 9, OHIO Melrose 6862

•

DETROIT
L. S. HOUSE
3-167 General Motors Bldg., Madison 5781

INJECTION AND COMPRESSION MOLDING

TURNING TO KITCHENS

Kitchen utensil handles, knobs and fixtures are second to war products right now, but they are on tomorrow's first page. Fabrication of unusual shapes and sizes involves plastic engineering, specialized skills, and sound knowledge of the structures of every plastic material.

We would like to discuss these with you in terms of your future kitchen utensil items.

We specialize in the custom fabrication of plastic parts of every description.

Catalin Acrylics Polystyrene Cellulose Acetate Laminates

PLASTIC *Turning Co. Inc.*

LEOMINSTER, MASS.

WHEN TOTAL VICTORY IS ASSURED, THE EXPERIENCE OF "CONNECTICUT" WILL AGAIN BE AVAILABLE FOR YOUR PEACE TIME REQUIREMENTS.

"Call on Connecticut"

Let us help you plan for your post-war production . . . show you how to improve the beauty of your products and reduce your manufacturing costs through the use of quality custom molded plastics.

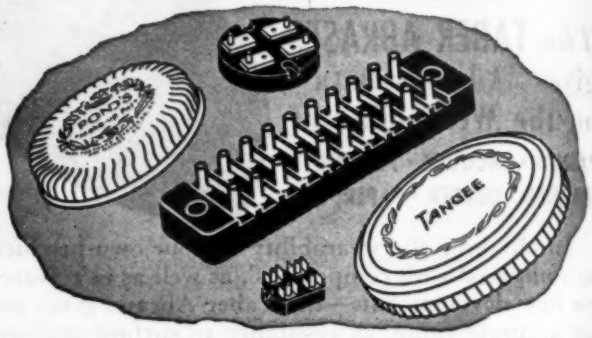
Custom CONNECTICUT Plastics Molders

CONNECTICUT PLASTIC PRODUCTS CO.

70 WEST LIBERTY STREET — WATERBURY, CONNECTICUT

WATERBURY

MOLDINGS OF MERIT

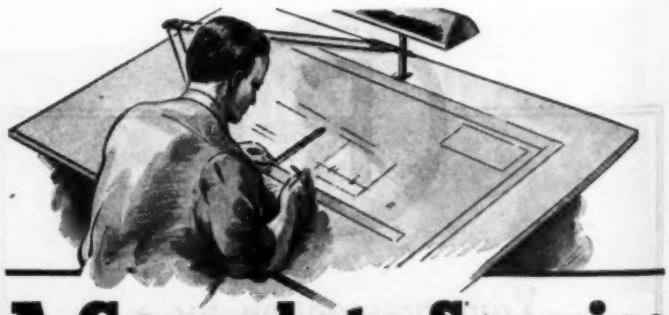


Custom Molders of all available Plastic Materials by Compression, Transfer, and Injection. Write us about your requirements.

WATERBURY COMPANIES, Inc.

Formerly Waterbury Button Co., Est. 1812

Dept. B, Waterbury, Connecticut



A Complete Service

• ENGINEERING • DESIGNING • MOLD MAKING
• MOLDING • FINISHING • FINAL INSPECTION

Here, in one organization, we have all facilities to handle every detail of compression and transfer molding of thermosetting plastics. Our engineers and designers are highly skilled in every phase of plastic molding procedure. Our two modern plants are geared to produce plastic parts by the hundreds or millions. Prompt, expert attention awaits your inquiry.

TAYLOR HI-EFF MANUFACTURING CO.

3084 W. Melnecke Ave., Milwaukee 10, Wis. • Representatives in 20 Cities

We serve not only as Custom Moulders but also offer complete assembly service. We solicit inquiries on war work and invite consultation on future planning. For information on our Standard Navy and Maritime Fittings consult Graybar Electric Company.
Distributed by GraybaR

Northern Industrial Chemical Company

7-11 ELKINS ST., SO. BOSTON 27, MASS.

35 YEARS OF PLASTIC MOLDING EXPERIENCE

Complete Plastic *Fabricating Facilities* FOR INDUSTRIAL USE

OIL CUPS, LENSES, MACHINE GUARDS, WASHERS, RINGS, GASKETS, ETC. FABRICATED FROM LUCITE, PLEXIGLAS, VINYLS AND OTHER PLASTICS...ARE ECONOMICAL—PERFORM WITH GREATER EFFICIENCY. When practical the extreme flexibility of the different plastics offer many qualities which prove extremely advantageous for industrial use. Our complete facilities and skilled engineers are now available for war work and post-war work. Show us samples or blueprints—we'll tell you if your product should be made from plastics. Wire or write today, attention Department MP.

TRANSPARENT *Specialties Corp*

1128 CARNEGIE AVE. CLEVELAND 15, OHIO

• ACRYLICS • CELLULOSE ACETATE • POLYSTYRENE • ETHYL CELLULOSE • VINYL RESINS

Dealers in PLASTICS SCRAP

MEYER & BROWN CORP.

Founded 1894

347 Madison Ave., New York 17, N. Y.

The time is coming when you may require *specialized* experience on vinyl resin, pyroxylin or other plastic coatings.

Because the future of your fabric will depend on the ability of the fabric coaters you choose, it's well to remember this: *products from our plants are being sold in Grade A outlets . . . are being featured by distributors noted for the highest quality standards.*

Why not consult us on your post-war plans?

We are equipped to produce: waterproof baby pants, crib covers, bibs, sanitary goods and coated fabrics for hospital use, shower curtains, raincoats, upholstery fabrics, drapery goods, food covers, utility aprons, shampoo capes, garment covers, bathing caps and industrial products.

BORTMAN PLASTICS
Company
183 Essex St. Boston 11, Mass.

Remove Moisture from PLASTICS

Quickly and Cheaply with NALCO *Infra-Red* LAMPS

Do you know . . . all of the advantages of Infra-Red Ray Drying with Nalco Dritherm Carbon Filament Lamps?

Use Nalco Ditherm Lamps for efficient results . . . available in Inside-Silvered (self-reflecting) or clear glass types.

Learn all of the advantages of the Infra-Red process for plastic dehydration.

Write for your free copy of "Drying Problems Made Easy" today.

Exterior of Infra-Red Conveyor Belt Tunnel for removing moisture from plastic material prior to molding.

Sides dropped to show arrangement of Infra-Red light bank and materials passing under light conveyor belt.

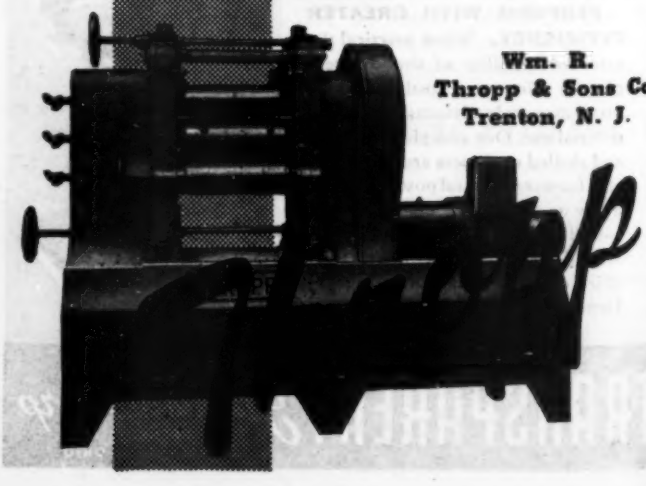
North American Electric Lamp Co.
1012 Tyler Street St. Louis 6, Missouri

---

for *Plastics*

New 6 x 16 LABORATORY CALENDER

• • built to duplicate functions of large production units. The rolls are of the finest chilled iron, hollow chambered for heating or cooling, and may be operated at either friction or even motion ... with the NEW G. E. Thy-mo-trol Drive, an infinite speed range may be obtained. Write for specifications.



Wm. R. Thropp & Sons Co.
Trenton, N. J.

Good Scales are the Secret of Good Plastics...

EXACT WEIGHT Scale in a Plastics molding operation on the west coast in the plant of McDonald Manufacturing Co., Los Angeles, California.

do it the Exact Weight Way...

Good plastic products start with skillful, careful ingredient compounding. The finished product is vitally effected by this first operation. This task requires not only skill but the right tools in the form of good scales. Your ingredient compounding requires accuracy....utmost accuracy. Such accuracy can only be gotten with sound pre-determined weighing. EXACT WEIGHT Scales are these type of scales. They have been used in the industry since the industry started. More of them are used today than ever before because they deliver the goods. Other uses include color blending and check-weighing of finished molds.

Write for the details.

INDUSTRIAL PRECISION

Exact Weight Scales

THE EXACT WEIGHT SCALE COMPANY

650 W. FIFTH AVE. COLUMBUS 8, OHIO

Dept. AC, 783 Yonge St. Toronto, Canada

Helmet Liner Scrap

Low-Cost Molding Compound

We have an ample and continuous supply of this scrap, which makes an excellent molding compound of the phenol-formaldehyde type. If you are not familiar with its ever-widening possibilities, by all means let us give you the story, as this material is a genuinely important opportunity for molders of many types of articles.

Samples, Prices, etc., Promptly Sent

Rayco Fillers for free-flowing molding compounds

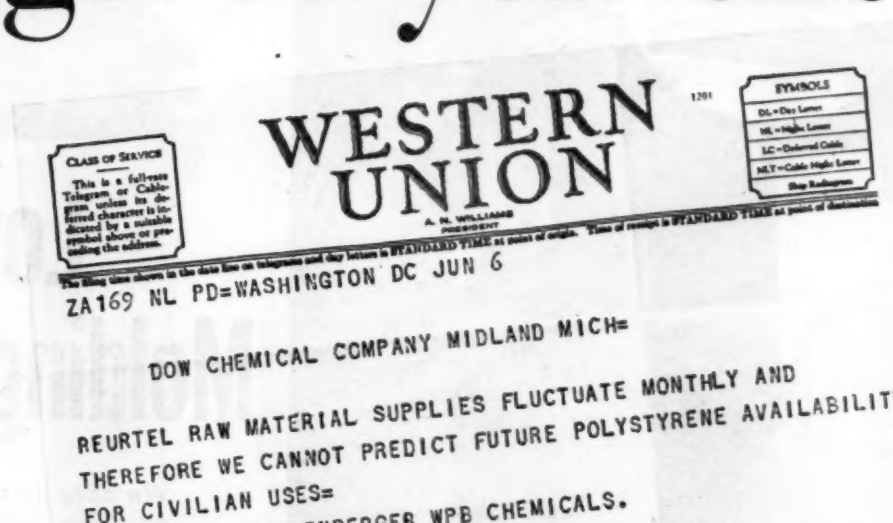
RAYON PROCESSING CO. of R.I. INC.

TREMONT ST., CENTRAL FALLS, RHODE ISLAND

Developers and Producers of Cotton Fillers for Plastics

you've heard the rumors . . .

Dow gives you the facts on Polystyrene supply


WESTERN UNION
CLASS OF SERVICE
SYMBOLS
ZA169 NL PD=WASHINGTON DC JUN 6
DOW CHEMICAL COMPANY MIDLAND MICH=
REURTEL RAW MATERIAL SUPPLIES FLUCTUATE MONTHLY AND
THEREFORE WE CANNOT PREDICT FUTURE POLYSTYRENE AVAILABILITY
FOR CIVILIAN USES=
GEO H SOLLENBERGER WPB CHEMICALS.

Contrary to many rumors, polystyrene is *not* freely available. We wish it were. Apparently you do too.

WPB is working with every polystyrene producer and supplier to make the most material available to *everyone* as soon as possible. But military needs—which still come first—must be balanced against supply of benzene and production capacity.

These factors are uncertain, changing—one thing today, different tomorrow. As the Nation's largest producer of polystyrene, we'd like to be more specific—but obviously can't. You can be sure that we're doing everything possible to meet your needs and anticipate your growing demands: spreading the benefits of *every available pound of polystyrene* to help keep the nation's employment at the highest level.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle

don't put your molder on the spot ● When you talk to your molder about polystyrene —REMEMBER—war still creates shortages beyond his control. He's working with us—and will be ready to serve your full *peacetime* needs at the earliest possible moment. "Let's Work It Out Together!"

STYRON
(DOW POLYSTYRENE)

DOW PLASTICS

STYRON • ETHOCEL • ETHOCEL SHEETING
SARAN • SARAN FILM • STYRALOY • STRIPCOAT

All classified advertising payable in advance of publication. Minimum, $5.00 (up to 60 words); in border, $10.00 per inch.

Classified Advertisements

For further information address Classified Advertising Dept. MODERN PLASTICS 122 East 42nd St., New York 17, N. Y.

WILL MANUFACTURERS who have new ideas and patents in connection with articles made of Thermo Plastic materials, which can be produced through the injection Moulding process, communicate with us with reference to post-war business, as we are prepared to produce these articles in the United Kingdom for Europe and the Overseas Market, without clashing with the original manufacturers. O. & M. Kleeman Ltd., Mappin House, 156/162 Oxford Street, London W.1., England.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

FOR SALE: 14 complete high and low pressure Dunning & Boschert Lever Valves, suitable for 75 to 450 ton presses, operating at pressures of 4,000# and less.

AMERICAN INSULATOR CORPORATION
New Freedom, Penna.

SPENCE-RIGOLO

PRODUCT DESIGN & STYLING

677 Fifth Ave., New York 22, N. Y.

FOR SALE—1 Worthington Hyd. Pump 1 x 6, 5 GPM 6000 pressure M.D. 1 Set 18" x 36" compounding rolls. 1—14" x 24" Press, 9" ram; 4—24" x 55" steel cord Heating Platens; 4—W. & P. Mixers; 4—Semi-Automatic 100-ton Hydr. Presses, platen area 20" x 36"; Allen 6" Tuber; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box 447, Modern Plastics.

CANADA, A Large Post War Market—Wide-awake, reliable Canadian sales organization, having connections with wholesale hardware, chain and department store trade, can accept representation for additional factory requiring Canadian factory agents operating on commission basis, providing line does not conflict with present representations. H. HACKING CO. LTD., 144 Water Street, Vancouver, Canada (Est. 1916). Canadian Branches from Coast to Coast.

PLEXIGLAS and LUCITE SCRAP WANTED. Interested in small and large quantities of clean, irregular-shaped flat pieces, strips, rods and other cut-offs. All thicknesses; masked and unmasked. Kindly describe fully, stating quantity available. Box 1210, Modern Plastics. FOR SALE: 1—500 ton Hydraulic Press with downward moving ram and pushbacks. Box 512, Modern Plastics.

FOR SALE: 1—500 ton Hydraulic Press with downward moving ram and pushbacks. Box 512, Modern Plastics.

WANTED: PLASTIC SCRAP OR REJECTS in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Acrylic and Vinyl Resin materials. Submit samples and details of quantities, grades and color for our quotations. Reply Box 508, Modern Plastics.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

PLASTICS INJECTION MOLDING DIES for 4, or 6 or 8 ounce cylinder for buttons or similar items wanted. Reply Box 1269, Modern Plastics.

FOR SALE: Hydraulic Presses, 600 ton Watson Stillman downward double acting ram, platen 24" x 24", 1—36" x 36" 12" ram, 200 ton all steel construction, 4—20" x 20" 10" rams, 1—24" x 24" 12" ram. 1—52" x 26" 14" ram, 400 ton capacity, 4—12" x 12" 7½" rams, 3—12" x 12" 8" rams, 1—32" x 50" 15" ram, 4 openings, 1—26" x 45" 10" ram, 2—15" x 15" 8½" rams, 1 Hanna Hydraulic Cylinder double acting 7" ram, 12' stroke, Pumps: Robertson Triplex 5 GPM 5000 lbs. Deane Triplex 4 GPM 2500 lbs., HPM Triplex 1½ GPM 2500 lbs., 4 plunger vertical 4 GPM 2250 lbs., National Triplex 3 GPM 4000 lbs., Hele Shaw JLP 12, 44 GPM 1200 lbs., HPM 1¾ GPM 2000 lbs. on high, 16 GPM 400 lbs. on low, V Belt Drive, Accumulators; Hydro-Pneumatic 4½" dia. plunger 27" stroke with By-Pass Valve, Extruder; Adamson 8" Strainer head, Mills, Calenders, Mixers, etc. Advise your requirements. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 285 Hudson Street, New York City 13.

PLASTICS ENGINEER, thoroughly familiar with all phases of the plastics industry, wanted for foreign sales promotion. Knowledge foreign langauges desirable. Reply Box 1270, Modern Plastics.

ESTABLISH OWN EXPORT DEPT!! little will it cost you to have it done by a man who has the "know how." Accountant and Office Manager of prominent exporter with personal contacts abroad, 36, married, citizen, university degrees, A-1 experience and references, languages. East Coast only. Reply Box 1271, Modern Plastics.

WANTED—Old established company desires the services of an experienced injection plastics production man. Excellent opportunity for man who understands every phase of injection moulding. All replies confidential. Submit full details, experience and qualifications. Box No. 1272, Modern Plastics.

RESEARCH TECHNICIAN with knowledge of hard and soft wallboard. Some experience in plastics desirable. This is really an opportunity for an able man to get in on the ground floor with a new subsidiary of an old established concern. Replies will be treated confidentially. Reply Box 1273, Modern Plastics.

WANTED: Injection molding die. Can use comb dies all sizes: 5", 7", 7½" and 8" comb. Also molding dies suitable for charms, for key rings and jewelry items. Give full description cavities and so forth. Reply Box 1274, Modern Plastics.

SALESMAN WANTED

Experienced in the sale of phenolics for casting, laminating and adhesives. Must have technical knowledge necessary to select and demonstrate modifications required for various uses.

Write giving age, experience, education and salary expected.

Reply Box 1275, Modern Plastics

FOR SALE 50,000 pounds of clear compression molding lucite powder. Reply Box 1276, Modern Plastics.

PLASTIC LINE WANTED—Progressive young Boston firm covering New England desires to represent plastics manufacturer on commission basis or will finance. BRADFORD MFG. CO., 104 Hanover Street, Boston 13, Mass.

WANTED: FABRICATING FOREMAN Working Foreman by small custom fabricator. Excellent salary and future to right man who understands quality production in acrylics and cast phenolics. Permanent position. Write giving age, previous experience, salary expected. Located large mid-west city. Box 1279, Modern Plastics.

NATIONAL SALES and distributing organization desires suitable lines for furniture stores on commission or jobbing basis. Reply Box 1277, Modern Plastics.

PACIFIC COAST DISTRIBUTION

New plastics sales and distribution organization wants to represent manufacturers of raw materials, equipment, supplies, etc. Intensive coverage of plastics molders, laminators, fabricators, and allied industries. Organization has long experience in plastics industry and is capable of assisting customers in technical problems, product development and marketing. Interested manufacturers will receive sound development of Pacific Coast market and ground-work for future export market. Address Box 1278, Modern Plastics.

FOR SALE

1—Rodgers 2 plunger Oil Pump 2 GPM 3000#; 1—Logan Oil Pump 5 GPM 750#; 3—Vickers Oil Pumps 17 GPM 500 to 1000#; 1—Metalwood Horizontal 4 plunger 1 GPM 3000#; 1—Rumsey Vertical Triplex 300 cubic inches 3000#; 2—Deane Worthington Triplex Pumps 400 cubic inches 4000#; 1—Gould Vertical Triplex 24 GPM 2500#; 1—Robertson Vertical Triplex Pump 7 GPM 5000#; 1—Robertson Vertical Triplex Pump 4 GPM 6500#; 2—Gould Vertical Triplex Pumps 200 GPM 500#; 1—Elmes Horizontal 4 plunger 6½ gallons 5000#; 1—Watson Stillman Horizontal 4 plunger 11 GPM 5000#; 2—Galland Henning Horizontal 4 plunger Pumps 50 GPM 2000#; 2—42 x 42" 14" ram presses; 2—80 ton Elmes 17 x 17" downward-moving ram presses; 1—Elmes 50 ton 18 x 18" downward-moving ram press; 2—30 ton Watson Stillman 12 x 12" Laboratory Presses. Reply Box 1225, Modern Plastics.

WANTED, Plastic Molding plant with hydraulic compression presses, and Injection Molding machines. Give full particulars and price. Reply Box 1280, Modern Plastics.

WANTED FACTORY MANAGER

Post War Future

Established Up State New York

Firm Employing Approximately 500

Plastic Molding or Woodworking

Experience Desirable But Not Essential

Submit Complete Details

Box 1282, Modern Plastics

WANTED—Molded ornaments for key chains—Pistols, Dice, Foot and Basket Balls or any new novelties, also combs. St. Marks Specialty Co., 30 E. 22nd St., New York City 10.

ADHESIVE CHEMIST—Research and development. Experience in the use and preparation of adhesives of the water dispersion type, and cut back type.

Company has excellent post war future—wonderful opportunities for right man Location—Metropolitan New York Area. Send complete resumes including draft status to Box 1283, Modern Plastics.

FOR SALE: App. 800 lbs. of Dental Acrylic Molding powder, pink and clear. Also methyl methacrylate monomer. Prices and samples on request. Reply Box 1284, Modern Plastics.

FOR SALE: Watson-Stillman 225 ton Transfer Molding Press; Farquhar & Farrel Birm., 150 ton; D. & B. 120 ton; Molding Presses 50 to 250 tons: 36″ x 36″, 30″ x 40″, 16″ x 16″, 12″ x 12″, 30″ x 36″, 24″ x 36″, 24″ x 36″, 22″ x 24″, 25″ x 36″, 48″ x 26″; 40 ton Broaching Press; 400 ton Extrusion Press; W. S. Horiz. 4 plgr., 1″ & 2″ x 4″, high & low pressure pump; W. S. 1¾″ x 12″ horiz. 4 plgr. 30 GPM, 3500 lbs. H. P. M. 1¾″ x 6″, vert. Triplex, 10 GPM, 2700 lbs.; 2—Oilgear Pumps, 13 GPM and 1250 lbs.; Wat.-Farrel 1¼″ x 4″, vert. triplex, 6 GPM, 3000 lbs.; Goulds 2¼″ x 8″ vert. triplex 30 GPM, 1600 lbs.; Elmes 1″ x 4″ & 1½″ x 4″ horiz. 4 Plgr., 5 to 8 GPM, 4500 lbs. & 5500 lbs. Rumsey 4½″ x 8″ vert. triplex, 65 GPM, 900 lbs.; 10 HP Horiz. 1¼″ x 4″ triplex 6 GPM, 3000 lbs.; 10 New Vickers Oil Pumps, 28 GPM, 1000 lbs.; Hydr. Steam Pumps up to 150 GPM; Hand Pumps; Low Pressure Pumps from 150 to 600 lbs.; Hydr. Accumulators, New Vickers 1¼″ Oil Relief Valves; New Vickers ¾″ Flow Control Valves; Royle #2 Extruder; ½″ to ¾″ Preform Tablet Machines; Heavy Duty Mixers; Ball & Jewell #1½ Rotary Cutter; Ball Bearing Roller Conveyor, Grinders, Pulverizers, Gas Boilers, Tanks, etc. ONLY PARTIAL LISTING. WE BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO., 426 BROOME ST., NEW YORK 13, N. Y. CANAL 6-8147.

LINES WANTED: Would like to contact manufacturers of either finished or unfinished products in the plastic field. We are in an excellent position to cover trade both in the industrial and retail markets of New England. Are thoroughly familiar with the chemical and plastic fields and all its aspects. Maintain Boston office—commission basis or will finance. Reply Box 1285, Modern Plastics.

POSITION WANTED—Plastics technician, 40 yr. old, married, 16 yr. experience in Plastics Industry. Extensive experience in Transfer and Compression molding, Mold Design, Press room set up, Mold Repairs, Molding Technique, Estimating and Finishing. Location secondary. Relpy Box 1286, Modern Plastics.

ROYALTY or outright sale desired of rights to plastic cover for National Aircraft Standard terminal strips. U. S. patent applied for. Applications in aircraft, radio and other electrical systems where NAS terminal strips are used. Model and drawing available. Irving M. Liss, 10 Burnside Drive, Toronto 10, Ontario.

SOON AVAILABLE
PLASTICS ENGINEER AND MANAGER
Experienced in compression and injection molding, manager of plastics division of well known company, author of 16 technical articles on plastics, 34 yrs. old, college education, desires management in plastics engineering and production or work in sales engineering. Reply Box 1287, Modern Plastics.

WANTED—Man who knows plastics fabrication to handle sample making and development laboratory of newly created plastics container department of a long established paperboard container company located in Brooklyn. The right man will advance with the department. Write fully stating age, experience, and salary requirements. Reply Box 1288, Modern Plastics.

WANTED: Plastics Engineer—General Factory Superintendent. Must have complete knowledge of compression and injection molding. Also general knowledge of factory management and factory products. Supervision over approximately 300 men. Good opportunity for man with general mechanical experience. Reply Box 1290, Modern Plastics.

DIE MAKER thoroughly experienced on plastic injection molds to take charge molding dept. Los Angeles firm. Excellent opportunity for fully qualified man to get in on ground floor. Top wages. Write completely covering previous experience, draft status and your knowledge of injection molds. Reply Box 1281, Modern Plastics.

WANTED: PLASTIC MANUFACTURING ORGANIZATION located on the east coast is looking for a MASTER MECHANIC to supervise toolroom, tool maintenance and plant maintenance. Must be capable of accurately estimating intricate plastic molds. Prefer individual with plastic experience but others considered. Good post war possibilities. Reply stating age, experience, salary, etc. Reply Box 1289, Modern Plastics.

WANTED—Small order medium sized Plastic moulding plant with or without tool shop. Part interest considered. Advise details. Answer: Box 1291, Modern Plastics.

WANTED—Lucite or plexiglas sheets and or off cuts urgently required, any thickness, any quantity, bought for cash, also scrap lucite or plexiglas, any quantity in carload lots. L & S Plastics Supply Co., 809-11 6th Avenue, New York 1, N. Y.

FREE LANCE preparation of advertisements and booklets, on plastics, solicited by experienced copywriter. Can supervise complete production and can handle photography. New York area. Reply Box 1292, Modern Plastics.

SPECIALISTS

INJECTION MOLDING

THE GROTELITE CO.

INCORPORATED
GRANDVIEW & LAFAYETTE AVE.
BELLEVUE, KENTUCKY

"PIONEERS IN PLASTICS"

ESTABLISHED 1922

Avoid costly errors in post war products. MODEL before you MOLD.

COMPRESSION - INJECTION - TRANSFER MOLDS

STRICKER BRUNHUBER CO.
Mechanical Developers
19 WEST 24th ST. SB NEW YORK 10, N. Y.
WAtkins 9-0191

Will your Post-war Product Plans take this hurdle in stride?

HAVE YOU given assembly its proper attention in planning your post-war product – or will your time sheets tell you, after you are all set up, that fastening "bugs" are eating up savings you could have been making?

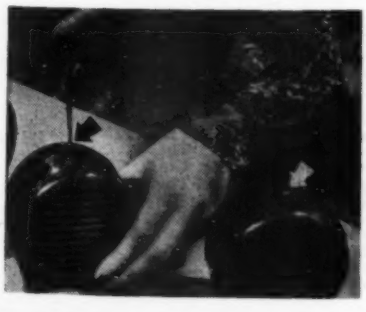
NOW, BEFORE YOU START production, question every fastening. Find out where you can use the short cut method – with P-K Self-tapping Screws – before you put up with slower, more complicated methods.

IN 7 OUT OF 10 CASES experience proves that with P-K Screws you can save time – speed assembly – cut costs – reduce rejects – improve products – by eliminating needless tapping, awkward bolting, costly inserts in plastics that slow up molding.

ASK A P-K ASSEMBLY ENGINEER to help you find all the savings you can make – often from 30% to 50% – or, send assembly details for recommendations.

HELPFUL FASTENING GUIDE—FREE!

The 18 tab-indexed pages are crammed full of information on where and how to use P-K Self-tapping Screws, in metals or plastics. File size, fitted with wall-hanger. Write for it. Parker-Kalon Corp., 208 Varick St., New York 14, N. Y.



ASSEMBLY TIME CUT 50% – INSERTS AND TAPPING ELIMINATED

One of the largest manufacturers in the radio field uses P-K Type "F" Self-tapping Screws in the assembly of this microphone – to fasten the two plastic sections together at three points. Multiply their 50% time saving with this method by the millions of screws used, and you'll see why it will pay to question your fastenings – now!

PARKER-KALON
Quality-Controlled
SELF-TAPPING SCREWS

FOR EVERY METAL AND PLASTIC ASSEMBLY

INDEX TO ADVERTISEMENTS

Accurate Molding Corp. 230
Adel Precision Products Corp. 230
Airtronics Mfg. Co. 203
Allied Products Corp. 39
American Cyanamid Co. 142–143
American Insulator Corp. 211
American Plastics Corp. 218
American Screw Co. 78, 168
Amos Molded Plastics. 31
Anigraphic Process, Inc. 212
Armour & Co. 215
Aro Equipment Corp., The. 87
Atlantic Screw Works. 78
Atlas Valve Co. 206
Auburn Button Works. 225

Bakelite Corp. Inside Back Cover
Baker Castor Oil. 77
Baldwin Locomotive Works, Baldwin Southwark Div. 50
Ball & Jewell. 217
Bamberger, A. 222
Barnes, W. O., Co., Inc. 208
Becco Sales Corp. 214
Behr-Manning. 90
Bell Telephone Laboratories. 26
Benchmaster Mfg. Co. 227
Boonton Molding Co. 64
Bortman Plastics Co. 242
Bridgeport Molded Products, Inc. 198
Brilhart, Arnold, Ltd. 51
Bristol Co., The. 78
Bryant Electric Co. 80
Buffalo Electro-Chemical Co., Inc. 214
Buttondex Corp. 234

Cambridge Instrument Co., Inc. 212
Carborundum Co., The. 200
Carver, Fred S. 196
Catalin Corp. 3
Celanese Plastics Corp. 9
Celluplastic Corp. 205
Central Screw Co. 78
Chandler Products Corp. 78
Chemaco Corp. 53
Chicago Molded Products Corp. 27
Chiksan Tool Co. 206
Ciba Products Corp. 221
Claremont Waste Mfg. Co. 144
Classified. 245, 246
Columbia Protektosite Co., Inc. 24
Condor Engineering Co. 237
Connecticut Plastics Products Co. 240
Consolidated Molded Products Corp. 67
Continental Can Co. 25, 172
Continental Diamond Fibre Co. 88
Continental Plastics Corp. 216
Continental Screw Co. 78
Cook, Lawrence H., Inc. 230
Corbin Screw Corp., The. 78
Cordo Chemical Corp. 165
Creative Printmakers Group. 238
Cruver Mfg. Co. 45
Cumberland Engineering Co. 229
Curran & Barry. 210

Dazor Mfg. Co. 28
Deering Milliken & Co., Inc. 57
Denison Engineering Co. 167
Detroit Macoid Corp. 169
Detroit Mold Engineering Co. 223
Detroit Wax Paper Co. 214
Dillon-Beck Mfg. Co. 220
Dow Chemical Co., The. 43, 244
Drakenfeld, B. F., Co. 228
du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept. 15
du Pont de Nemoures, E. I., & Co., Inc., Plastics Div. 23
Durez Plastics & Chemicals, Inc. Inside Front Cover
Durite Plastics, Inc. 209
Dutton, C. H., Co. 35

Elmes Engineering Works of American Steel Foundries. 81
Erie Engine & Mfg. Co. 219
Exact Weight Scale Co. 243

Farrel Birmingham Co., Inc. 32
Federal Telephone & Radio Corp. 79
Firestone Industrial Products, Velon Div. 179
Fortney Mfg. Co. 210
Franklin Plastics Div. 226
Freydberg Bros. Strauss, Inc., Plastics Div. 17

Gaylord Container Corp. 141
General American Transportation Corp. 170
General Electric Co. Back Cover
General Industries Co. 75
General Molded Products, Inc. 207
General Screw Mfg. Co. 78
Gering Products, Inc. 218
Girdler Corp., The. 89
Glycerine Producers' Assoc. 84
Goodrich, B. F., Chemical Co. 5
Greeff, R. W., & Co. 213
Grimshaw, Wm., & Sons. 214
Grotelite Co., Inc. 246

Hardesty Chemical Co., Inc. 47
Harper, H. M., Co., The. 78
Hercules Powder Co. 59
Howe, R. A., & Co. 231
Hydraulic Press Mfg. Co., The. 154

Ideal Plastics Corp. 220
Industrial Hard Chromium Co. 61
Industrial Molded Products Co. 232
Infra-Red Engineers & Designers. 213
Insulation Mfg. Co. 227
Interlake Chemical Corp., Plastics Div. 71
International Molded Plastics, Inc. 85
International Screw Co. 78
Irvington Varnish & Insulator Co. 197
Ivano, Inc. 206

Jones, C. Walker Co. 213

Kearney & Trecker Corp. 185
Kenilworth Plastics Molding Co. 216
Keyes Fibre Co. 189
Kingsley Gold Stamping Machine Co. 220
Kuhn & Jacob Molding & Tool Co. 229
Kurz-Kasch, Inc. 171
Kux Machine Co. 204

Lake Erie Engineering Corp. 86
Lakone Co., The. 222
Lamson & Sessions Co. 78
Lane, J. H., & Co. 217
Leominster Tool Co. 202
Lester Phoenix, Inc. 14
Lincoln Engineering Co. 195
Lucidol Corp. 233

Mack Molding Co. 72
MacRae's Blue Book. 215
Magnetic Plastics Co., The. 216
Makalot Corp. 82
Manufacturers Chemical Corp. 53
Manufacturers Screw Products. 78
Martindell Molding Co. 233
McAleer Mfg. Co. 212
McGraw Hill Book Co., Inc. 237
Mearl Corp., The. 234
Memphis and Shelby County. 164
Mercer-Robinson Co., Inc. 226
Metal Specialty Co., The. 163
Metaplast Corp. 235
Meyer & Brown Corp. 241
Michigan Molded Plastics, Inc. 217
Midland Die & Engraving Co. 36
Midwest Molding & Mfg. Co. 224
Milford Rivet & Machine Co. 78, 234
Mills, Elmer E., Corp. 33
Minnesota Plastics Corp. 236
Miracle Adhesives Corp. 218
Molded Products Co. 13
Monsanto Chemical Co. 41, 187
Mosinee Paper Mills Co. 183
Muehlstein, H., & Co., Inc. 215
Munising Paper Co. 52

National Adhesives. 12
National Erie Corp. 237
National Plastics Products Co. 232
National Rubber Machinery Co. 7
National Screw & Mfg. Co. 78, 92
National Transparent Plastics Co. 231
Newark Die Co., Inc. 236
New England Screw Co. 78
New York Air Brake Co., The. 66
Niacet Chemical Corp. 226
Niagara Alkali Co. 173
Nixon Nitration Works, Inc. 37
North American Electric Lamp Co. 242
Northern Industrial Chemical Co. 241
Northwest Plastics, Inc. 199
Norton Laboratories, Inc. 177
Numberall Stamp & Tool Co. 232

Oakite Products, Inc. 224
Owens Corning Fiberglas. 194

Panelyte Div., St. Regis Paper Co. 21
Parker-Kalon Corp. 78, 247
Pawtucket Screw Co. 78
Pennsylvania Coal Products Co. 34
Pheoll Mfg. Co. 78
Phillips Screw Mfg. Co. 78
Plaskon Div. 138–139
Plastic Film Corp. 11
Plastic Manufacturers, Inc. 56
Plastic Turning Co., Inc. 239
Plastics Industries Technical Institute. 68
Plastimold, Inc. 231
Plax Corp. 55
Porter Cable Machine Co. 201
Pro-phy-lac-tic Brush Co., Prolon Plastics Div. 10

Racine Tool & Machine Co. 46
Radio Corp. of America. 83
Radio Receptor, Inc. 62
Rayon Processing Co. of R. I., Inc. 243
Rayonier, Inc. 236
Reading Screw Co. 78
Recto Molded Products, Inc. 239
Reed-Prentice Corp. 8
Reichhold Chemicals, Inc. 166
Richardson Co., The. 6
Riegel Paper Corp. 30
Rogan Bros. 228
Rohm & Haas Co. 29
Royle, John & Sons. 74
Russell Burdsall & Ward Bolt & Nut Co. 78

Santay Corp. 70
Schauer Machine Co. 223
Scientific Electric Co. 42
Scovill Mfg. Co. 78
Shakeproof, Inc. 78
Shaw Insulator Co. 54
Shellmar Products Co. 249
Simmons Fastener Corp. 48–49
Simonds Saw & Steel Co. 219
South Bend Lathe Works. 40
Southern Chemical Cotton Co. 181
Southington Hardware Mfg. Co. 78
Stack Plastics. 210
Standard Chemical Co. 238
Standard Products Co., The. 91
Standard Tool Co. 233
Stanley Electric Tools, Carter Div. 227
Steel Co. of Canada, Ltd., The. 78
Sterling Plastics Co. 16
Stokes, F. J., Machine Co. 44
Stricker Brunhuber Co. 246
Surprenant Electrical Insulation Co. 235

Taber Instrument Corp. 239
Tannewitz Works, The. 208
Taylor Mfg. Co. 240
Tech-Art Plastics Co. 175
Teckna Co. 224
Tennessee Eastman Corp. 153
Thropp, Wm. R., & Sons Co. 242
Timken Roller Bearing Co. 69, 73
Tinnerman Products, Inc. 191
Transparent Specialties Corp. 241

Union Carbide & Carbon Corp. Inside Back Cover
United States Plywood Corp. 18–19
United States Testing Co., Inc. 20
Universal Plastics Corp. 63

Varcum Chemical Corp. 38
Victory Mfg. Co. 228
Virginia-Lincoln Corp. 193

Walker Turner Co., Inc. 65
Waterbury Companies, Inc. 240
Watertown Mfg. Co., The. 58
Watlow Electric Mfg. Co. 223
Watson-Stillman Co., The. 60
Westinghouse Electric Corp. 76
Wiegand, Edwin L., Co. 22
Winner Mfg. Co., Inc. 225
Wolverine Belt Co. 78
Wood, R. D., Co. 221
Worcester Moulded Plastics Co. 250

MODERN PLASTICS*
PLASTICS*
PLASTICS ENGINEERING*
PLASTICS PRODUCTS*
*REG. U. S. PATENT OFFICE

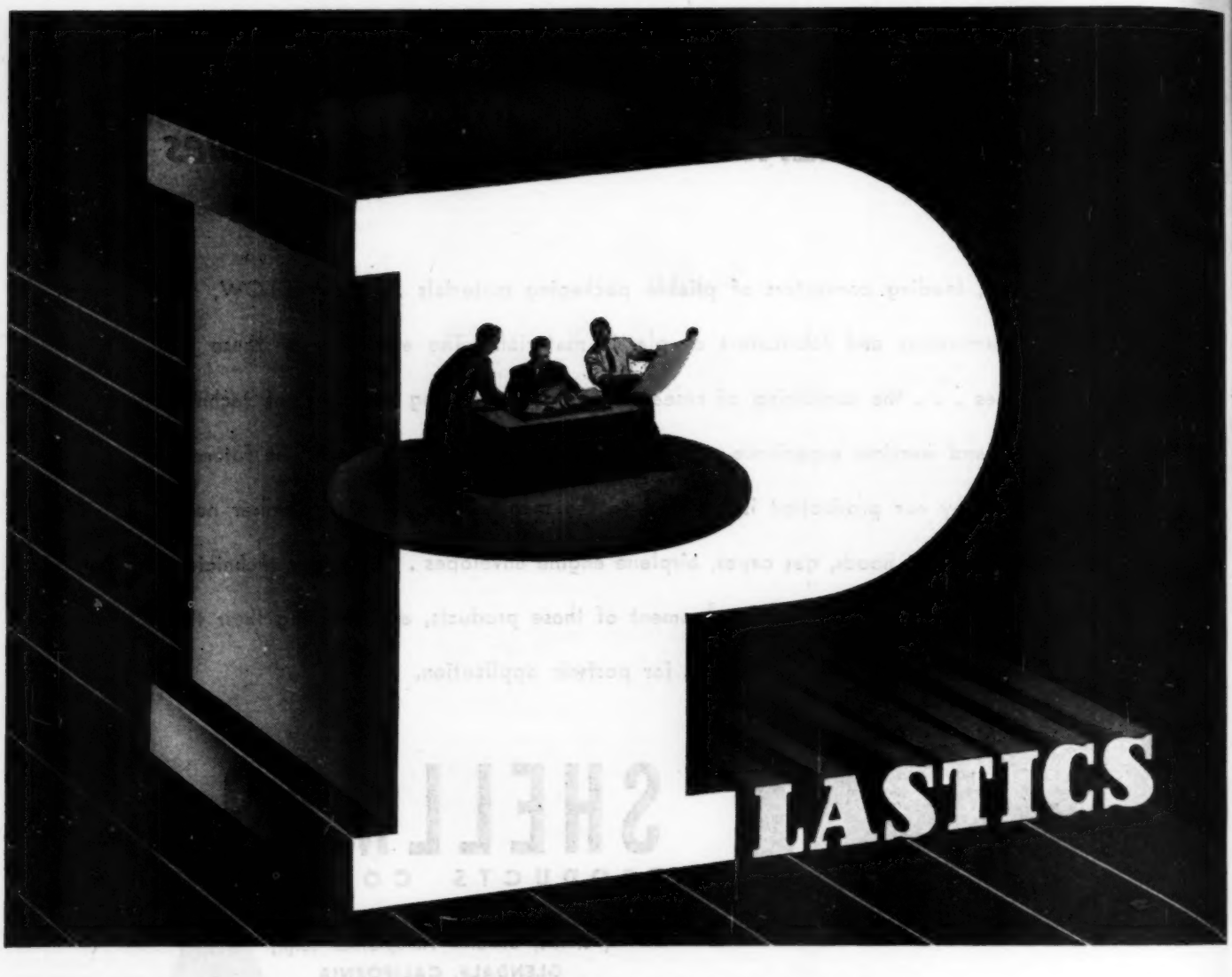
MODERN PLASTICS
Published by MODERN PLASTICS, INC.
122 EAST 42nd ST., NEW YORK 17, N. Y.

... 224
... 194
... 21
..78, 247
... 78
... 34
... 78
... 78
.138–139
... 11
... 56
... 239
... 68
... 231
... 55
... 201
tics
... 10
... 46
... 83
... 62
... 243
... 236
... 78
... 239
... 8
... 166
... 6
... 30
... 228
... 29
... 74
... 78
... 70
... 223
... 42
... 78
... 78
... 54
... 249
..48–49
... 219
... 40
... 181
... 78
... 210
... 238
... 91
... 233
... 227
... 78
... 16
... 44
... 246
... 235
... 239
... 208
... 240
... 175
... 224
... 153
... 242
..69, 73
... 191
... 241
k Cover
..18–19
... 20
... 63
... 38
... 228
... 193
... 65
... 240
... 58
... 223
... 60
... 76
... 22
... 225
... 78
... 221
... 250

LOOKING AHEAD... *with Two Great Names*

SHELLMAR, leading converters of pliable packaging materials . . . SWEDLOW, outstanding laminators and fabricators of plastic materials. The affiliation of these two great names . . . the combining of research and manufacturing facilities, of technical knowledge and wartime experience . . . promises unlimited possibilities in the future of plastics. Today our production is devoted to the manufacture of giant bomber noses, turrets and cockpit hoods, gas capes, airplane engine envelopes . . . but our technicians, the men who pioneered in the development of these products, are devoting their time to creating new materials and methods for postwar application.

SHELLMAR
PRODUCTS COMPANY
Plastics Division
(Formerly Swedlow Aeroplastics Corp.)
GLENDALE, CALIFORNIA



RIGHT IN A CAPITOL OF PLASTICS

Custom injection moulding by the Trio has served as a stronghold of plastics applications to an endless number of industries. Over and over, our die designing, die making and moulding skills have ironed out first one then another manufacturer's problem in the form of a plastics part or product. These applications have run the full gamut of precision requirements, water tightness, deep threading, dielectrical properties, corrosion resistance, complicated metal inserts, thin yet rigid wall thicknesses, and exactness of color. Furthermore they have met volume production and benefited thereby in prices. There's no telling how well these properties may fit some phase of your production, until you inquire. We would like to hear from you.

FOR CUSTOM INJECTION MOULDING . . . TRY THE TRIO

Custom Injection Moulding

WORCESTER MOULDED PLASTICS CO.

14 HYGEIA STREET, WORCESTER 8, MASS.

17 East 42nd St., New York 17, N. Y.
Export Office: 90 Broad St., New York 4, N. Y.

YES, SIR, ROOM 915's right next to the elevators, but guests sleep soundly and undisturbed. Elevator doors don't slam at the Gresham Arms, and they needn't slam in other buildings. Bumpers made of VINYLITE elastic plastics quietly absorb the shocks as doors fly open and swiftly close. And similarly, in bumpers for the doors, frames, and hoods of cars and trucks, these same plastics keep their resilience and show no appreciable wear over long periods of time.

VINYLITE elastic plastics are the outstanding material for almost countless products ranging from tiny grommets to electrical insulation for heavy cables. Along with its elastomeric qualities it is non-flammable or flame resisting, remarkably tough, and long lasting. It is highly resistant to sunlight, moisture, abrasion, grease, gasoline, and most chemicals. And VINYLITE elastic plastics are available as molding and extrusion compounds, as flexible sheeting and film, as compounds for coating cloth and paper—in bright colors and pastel tints — transparent, translucent, and opaque.

Bumpers made of VINYLITE elastic plastics by Electric Auto-Lite Company, Bay Manufacturing Division. They include a force-fit bumper; a bumper with a molded insert; another with a molded thread; and a flat bumper.

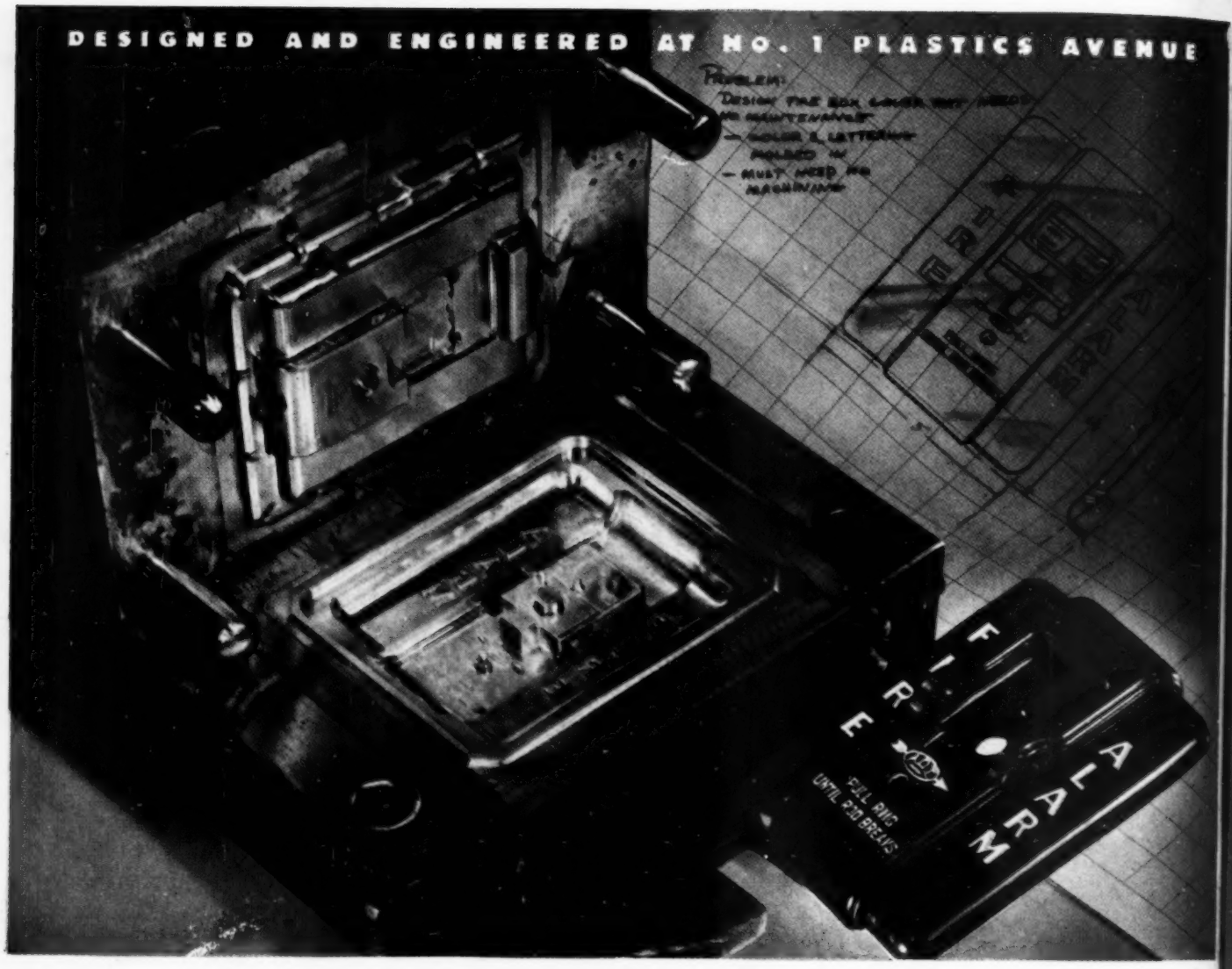
For applications that need or would be improved by elastomeric qualities, specify VINYLITE elastic plastics. Write Department 7 for detailed information.

BAKELITE CORPORATION
Unit of
Union Carbide and Carbon Corporation
UCC
30 EAST 42ND STREET, NEW YORK 17, N.Y.

Vinylite Plastics

TRADE-MARK

Mo 29 '44



A PLASTIC STORY THAT RINGS THE BELL

●Here's a fire alarm box cover that rates a second look. And its good looks are more than skin-deep.

Yes, its bright red color goes all the way through . . . it never needs to be painted—a wipe with a rag is all the maintenance it will ever require. And its crisp lettering is molded right in.

G. E.'s complete plastics service cooperated with the engineers to design, build the mold, and deliver finished covers to the American District Telegraph Company.

So successful is this cover design that ADT shop people do not have to do a single bit of machining—they merely assemble it into the finished box. Once again a plastic part saves time . . . saves weight . . . saves machining . . . saves maintenance.

General Electric's *complete* plastics service is available to all industry. If you have a plastics problem, you can get the answer from G. E.—world's largest manufacturer of plastics parts. Write to Plastics Divisions, General Electric Company, No. 1 Plastics Avenue, Pittsfield, Mass.

GENERAL ELECTRIC

CD45-A1

G-E Complete Service—Everything in Plastics

Backed by 51 years of experience, General Electric has been designing and manufacturing plastic products ever since 1894.

G-E Design and Engineering Service. Our own industrial designers and engineers work together. Result: plastics parts that are both scientifically sound and good-looking.

G-E Mold Service. Fully equipped toolrooms are manned by skilled craftsmen whose average precision mold experience is 12 years. G-E molds are chromium plated for longer life.

G-E Quality Control. Our plastic products may pass through as many as 160 inspections and analyses. Army-Navy rejections are so low as to be negligible at General Electric.

G-E Research works continually to develop new materials, new processes, new applications for plastics.

G-E Manufacturing Facilities are available for all types of plastic parts—for compression molding, injection molding, transfer molding, extrusion molding, cold molding, both high and low pressure laminating, and fabricating.

BUY WAR BONDS

Hear the General Electric radio programs: "The G-E All-Girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS. "G-E House Party" every weekday 4:00 P.M. EWT, CBS.